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FIELD EVALUATION OF EXPERIMENTAL DELINEATION

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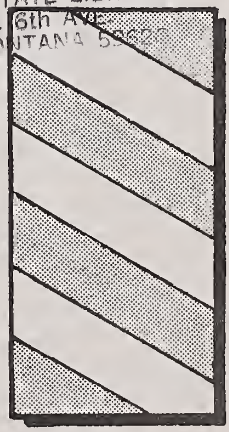

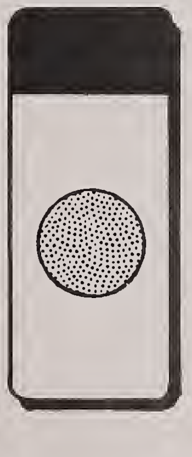

FINAL REPORT

PREPARED BY

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FINAL REPORT

FIELD EVALUATION

OF

EXPERIMENTAL DELINEATION

Planning and Research Bureau
MONTANA DEPARTMENT OF HIGHWAYS
2701 Prospect Avenue
Helena, Montana 59601

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SUMMARY

Highway post mounted delineators, in addition to edge and center stripes and other signs, are used to provide the motorist with information about the roadway ahead, such as width, grade and alignment. During darkness or periods of reduced visibility, the use of reflectorized delineators gives the motorist the information he needs to proceed with awareness and reasonable speed.

Traditionally, the most common post-mounted delineators have been either 4" x 4" squares, 4" x 6" rectangles, or 3" circular delineators, with limited use of larger signs. Relatively few in-depth studies have been conducted to evaluate the effectiveness of the various forms and most of these have dealt with limited aspects of specific delineation treatments. The use of post-mounted delineators as part of an overall system for roadway delineation has received little attention.

For certain types of roadway conditions, standard delineation treatments have not been completely effective in deterring run-off-the-road accidents. Consequently it has been felt that variations in size, shape, design and spacing could lead to a significant reduction of this type of accident. To test this hypothesis, The Montana Department of Highways in cooperation with the FHWA developed a program to install and evaluate a number of non-standard post-mounted delineators which have not previously been analyzed through objective analytical procedures.

The scope of this project was limited to the design, installation, and evaluation of four types of post-mounted delineators on twenty selected sections of highway. These twenty installations were evaluated for their relative effectiveness in reducing total accidents, night accidents, and total run-off-the-road accidents, with special emphasis on nighttime, run-off-the-road accidents. The installation of the delineators resulted in a 30% reduction of the night-time run-off-the-road accidents for the entire project, which was statistically significant at the 80% level of confidence.

The limited findings of this report suggest that improved delineation of specific areas of highways in general could lead to an overall reduced level

of accidents and to marked reductions of specific types of accidents. The study findings also suggest that well delineated highways are more asthetically pleasing, and are more pleasant to drive upon, especially at night. Furthermore, a benefit-cost ratio of 8.83 was achieved.

DISCUSSION

In February of 1978, the Planning and Research Bureau of the Montana Department of Highways entered into a contract with the Federal Highway Administration to investigate experimental post-mounted delineation. The contract specified the selection of four delineator configurations and five study evaluation sections for each configuration, for a total of twenty study evaluation sections.

In the selection of delineator configuration a variety of sizes, colors, shapes and designs were considered. A closely related factor which was considered and analyzed was the side-of-road spacing of the delineators.

All delineators were installed according to the Montana Department of Highways standard specification as to mounting height, placement in regard to shoulder lines, slopes and degree of the highway curves involved. Typical details for the post mounted delineators are located on pages 21, 22, 23 and 24 of the Appendix. Straight line diagrams exhibiting installation locations follow the appropriate typical sketch. Photographs depicting one roadway section of each of the configurations of delineator are included in the appendix. Collision diagrams for several of the areas are also included in the appendix. These diagrams show 'before' and 'after' accident types and numbers for those accidents which were assumed to be correctable by the delineation treatment.

TYPE I

Type I of the post mounted delineators was designed for use on flat, shallow curves and adjoining tangent sections of roadway. A delineator design of intermediate size (6" x 12" - larger than current standards but smaller than the others in this study) was desired because of the longer lengths of roadway generally accompanying this type of highway design. The design incorporated a 4" black dot superimposed on a silver high intensity reflectorized surface. With a smaller configuration, the cost of future projects using this style of delineator could be minimized.

TYPE II

A large variety of highway alignments were used as study sections for Type II post mounted delineators. These ranged from a straight roadway containing a bridge to several sharp curves. This style of delineator measures 12" x 36" and consists of alternating high intensity reflectorized yellow and balck diagonal stripes.

TYPE III

Type III post mounted delineators were used on curved and serpentine segments of roadway. The design of this delineator is a variation of the standard S1-1 'Object Marker' (12" x 36" - high intensity reflectorized silver and black diagonal striped.) In our variation, two 4' x 4" silver rhombus' are superimposed over two black stripes of the standard sign as shown on the typical detail, page 23. The addition of the two reflectorized 'silver rhombus' is felt to yield a more dramatic sign.

TYPE IV

The Type IV was used exclusively on single curves or on multiple 'S' type curves. The newly introduced W1-8 Chevron Alighment Sign (a 24" x 30" high intensity reflectorized yellow sign with a black arrow) was chosen to test the effectiveness of the new design.

In the selection of the twenty highway sections involved in the review, an existing computer 'accident cluster area' program was utilized. The program searched the State maintained Primary and Secondary Highway systems and identified sections of roadway, one mile in length, where eight or more nighttime run-off-the-roadway accidents had occurred over a five year period. Areas where reconstruction would occur within the next five years were omitted to permit continued uninterrupted surveillance of the delineator performance.

The accident records for the one-mile segments were then examined to identify specific problem areas or locations, which often condensed the section of roadway for which delineators were required. This reduced the mileage involved and afforded greater accuracy in the evaluation. Department

personnel conducted a field survey of these shorter highway sections and defined the delineator post locations at the same time. Posts and delineators were later installed by Department of Highways maintenance forces.

EVALUATION

The Before and After Study method was used to evaluate the effectiveness of the project. This procedure calls for the collection of pertinent data for a specific period before and after the improvement is made. The optimum time frame for data analysis would be for equal before and after time periods of at least three years.

In order to make the statistical tests as significant as possible, all available accident and traffic data was utilized. The accident data for the 'before' period ranged from 41 months to 67 months with an average of 63.9 months. As specified in the study contract, the project completion data was set for September 30, 1981. Therefore, the 'after' analysis period ranges from 36 to 49 months with the median falling at 37.4 months. The study staff feel the 'after' period is relatively equal to the 'before' period.

Rate-related calculations were chosen since annual ADT values are available and the rate formula used tends to equalize the dissimilarities of the before and after time periods. Analysis was performed for four catagories of accidents including a) run-off-the-roadway, b) nighttime, c) nighttime run-off-the-roadway and d) total. For these four groups of accident data, calculations were made to obtain the numbers of accidents and accident rates for each study area.

The accident rate formula is:

$$\text{Accident Rate} = \frac{\text{Total Numbers of Accidents} \times 1{,}000{,}000}{(\text{ADT}) \times (\text{Length of Roadway}) \times (\text{No. of Months}) \times 30.4}$$

The values derived from the above equation are presented in Tables II, III and IV.

All highway evaluation sections were first analyzed individually, then were combined by each type of delineator, and finally were combined for the project as an entirety.

Calculation of the percent change in accident rate, as presented in Table VI, was based upon the historic expected rate of increase in accidents. These percent changes are employed in the Poisson Test of Statistical Significance. The formula used to determine these values is:

$$\text{Percent Change of Rate} = \frac{Bi - Ai}{B_i} \times 100$$

where Ai = After accident rate
Bi = Before accident rate

The 80% level of confidence for the Poisson Test was used, based on the consideration that this was a relatively low cost program. The significance test was performed on each of the four accident groups by type of delineator and for the total program.

An economic justification analysis, using the Benefit-Cost Method was conducted on the night-time-run-off-the-road accidents where the categoric reduction was most significant. The estimated service life of the project was 10 years with the assumption of a negligible salvage value. The assumed interest rate was 8%. The annual cost for the overall project maintenance was estimated at $2,000.00. Costs for preliminary investigations and initial installations were $23,117.68.

The accident cost figures used in the economic analysis were those established by the National Safety Council (1980) of $170,000 for each fatality, $6,700 for each injury (independent of severity), and $980 for each property damage accident.

The desired units of effectiveness revolve around accident reduction. Therefore, the number of fatal, injury and property damage accidents that were reduced annually are used in the calculation of annual benefits rather than the number of fatalities or personal injuries.

The capital recovery factor was calculated using the following equation:

$$CR_n^i = \frac{i(1 + i)^n}{(1 + i)^n\ 1}$$

where, i= assumed interest rate

n= the service life of the project

$$CR_n^i = \frac{.08\ (1.08)^{10}}{(1.08)^{10}\ -1}$$

$$= 0.149$$

The Equivalent Uniform Annual Benefits (EUAB) was calculated using the following equation:

$$EUAB = \frac{ADT_a}{ADT_b}\ [170{,}000\ (A_f) + 6.700\ (A_i) + 980\ (A_{pd})]$$

where:

A_f = annual percentage fatal accidents reduced = .22

A_i= annual percentage injury accidents reduced = -.78

Apd= annual percentage property damage accidents reduced = 5.03

$$EUAB = \frac{3848.3}{2970.7}\ [170{,}000\ (.22) + 6700\ (-.78) + 980\ (5.03)]$$

$$= 48{,}064.43$$

The Equivalent Uniform Annual Cost (EUAC) was calculated using the following equation.

$$EUAC = (I)\ (CR_n^i) + M$$

where:

I = initial cost of the project
i = assumed interest rate
n = service life of the project
M = annual cost for maintenance

$$EUAC = (23{,}117.68)\ (0.149) + (2{,}000)$$
$$= 5444.53$$

The Benefit Cost ratio was calculated using the following equation:

$$\frac{B}{C} = \frac{EUAB}{EUAC} = \frac{47{,}064.43}{5444.53} = 8.83$$

The benefits of this project outweigh the costs incurred.

CONCLUSIONS

FIELD INVESTIGATION

From the nighttime field investigation of all study areas in August of 1978, it was the visual observation of study personnel that:

1. Installation of the Type I delineator (6" x 12" silver with a black dot) on variable spacing intervals, not in conformance with the standard fixed length interval, was necessary in order to be visually effective.
2. The installation of the Type II and Type III delineators (12" x 36" diagonally striped) on variable spacing intervals was visually effective.
3. It was the opinion of the study staff that the visual effect of the Type IV (Chevron) would be enhanced if the signs were installed at closer intervals.
4. The high intensity reflector material used on all of the delineators was clearly more visible than standard materials.

ACCIDENT HISTORIES

A comparison of the accident histories for the 64 month before period and the 37 month after period, for each type of delineator was performed in September of 1981. The majority of the areas show a reduction in the nighttime run-off-the-road accident rates. It was also shown that these delineators had a positive effect in reducing all accidents, including those which occurred in the daylight hours. Table IV shows the before and after accident rates along with the percentage change.

Results of the accident studies for the various delineator-study sections are as follows:

I. Evaluation of all the Type I delineator study areas indicated a decrease in the nighttime run-off-the-road accident rate of 12%, with a decrease of 10% in the overall total run-off-the-road accident rate. One of the areas involved in this group experienced no nighttime run-off-the-road accidents. This type

of delineator appears to be particularly effective on tangent, straight sections of roadway or those that have a slight curve of about 1° to 3°.

II. The Type II delineator showed the greatest overall reduction of accidents with a 51% reduction of nighttime run-off-the-road accidents for all five study areas. There was also a significant reduction in the total accident rate of 33%. The performance of this delineator was clearly better than the other three tested.

III. There was a statistically significant reduction in the nighttime run-off-the-road accident rate for Type III delineators of 28%. One of the study areas in this group (Coram-Hungry Horse) showed an increase for both total and daytime run-off-the-road accident rates. There was no obvious reason or explanation why the Coram-Hungry Horse study section ran counter to the trend of this group. Further investigation of the area are being be conducted.

IV. The Chevron-Type IV delineator indicated significant reduction in the nighttime run-off-the-road accident rate of 35%. This type of delineation produced the second greatest reduction in accidents and is particularly effective on sharp isolated curves. There was also a significant reduction in the run-off-the-road accident rate of 31%.

In the opinion of the evaluator, using all available data, the study objectives were clearly fulfilled by the post mounted installations. This is evidenced by the nighttime run-off-the-road accident rate reductions of 12%, 51%, 28% and 35% for delineator Types I, II, III, IV respectively. All were statistically significant at the 80% level of confidence. Furthermore a benefit-cost ratio of 8.83 was achieved. This ratio was calculated based upon the percent reduction of nighttime run-off-the-road accidents since this was the objective of the program.

The results of this evaluation indicate that the experimental project was successful in reducing nighttime run-off-the-road accidents.

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TABLES

JOB-1635

TABLE I

ROUTE	LOCATION - DESCRIPTION	MILEPOST FROM	MILEPOST TO	BEFORE DATE FROM 1-1-73 TO	# MONTHS	# MONTHS AFTER	ADT BEFORE	ADT AFTER	LENGTH IN MILES
P-7	Near Missoula	89.6	90.2	8-4-78	67	36	5924	8066	0.4
~~P-5~~	Evaro Hill	2.97	5.0	8-4-78	67	36	3786	4145	2.03
P-1	Kalispell	139.0	139.7	6-19-78	66	37	4206	4273	0.7
P-1	Near Cut Bank	253.8	254.44	6-14-78	65	38	2131	2557	0.44
P-28	Near Red Lodge	70.28	71.0	6-13-78	65	38	1184	1575	0.72
P-7	Near Missoula	88.6	89.3	8-4-78	67	36	5924	7995	0.7
P-5	South of Arlee	16.8	17.7	7-28-78	67	36	3382	3852	0.9
P-5	Curve Near Ravalli	24.7	25.7	7-27-78	67	36	3484	4119	1.0
~~P-8~~	West of Townsend	75.8	76.4	6-19-78	66	37	1892	2322	0.6
P-1	Near Havre	384.4	385.5	7-18-78	67	38	2988	3486	1.1
~~P-24~~	Rainbow Bend	8.5	9.0	10-9-75*	46	38	1737	2156	0.5
P-5	Near Polson	56.4	57.2	6-1-78	65	38	4207	5555	0.8
P-50	Near Big Sky	50.4	52.1	7-7-78	66	37	1370	1366	1.7
P-14	Deep Creek Canyon	8.3	9.1	6-21-78	66	37	402	543	0.8
~~P-1~~	Coram-Hungry Horse	142.3	143.9	5-15-76	41	49	2761	3579	1.6
P-7	Near Missoula	85.2	87.6	7-28-78	67	36	5924	9254	2.4
P-6	Plains to Paradise	77.6	78.5	7-27-78	67	36	1125	1424	0.9
S-205	Bozeman-Belgrade	22.0	23.0	5-30-78	65	36	2415	3139	1.0
P-82	Big Fork-Somers	4.7	5.5	5-26-78	65	37	2161	3792	0.8
P-1	Columbia Heights-E.	141.9	142.3	5-26-78	65	37	2411	3773	0.4
SUB-TOTALS BY TYPE OF DELINEATOR									
	TYPE I				66	37.0	3446.2	4123.2	4.29
	TYPE II				66.8	36.6	3534.0	4354.2	4.3
	TYPE III				56.8	39.8	2095.4	2639.8	5.4
	TYPE IV				65.8	36.6	2807.2	4276.4	5.5
TOTAL ALL AREAS					63.9	37.4	2970.7	3848.3	19.49

*Before Period from 1-1-72

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TABLE II - BEFORE ACCIDENT DATA

		NIGHT TIME RUN-OFF THE-ROADWAY				RUN-OFF-THE-ROADWAY				ALL NIGHT-TIME				ALL ACCIDENTS			
ROUTE	LOCATION-DESCRIPTION	TOTAL	FATAL	INJ.	P.D.	TOTAL	FATAL	INJ.	P.D.	TOTAL	FATAL	INJ.	P.D.	TOTAL	FATAL	INJ.	P.D.
P-7	Near Missoula	11	1	3	7	15	1	5	9	17	1	6	10	28	1	12	15
P-5	Evaro Hill	21	1	11	9	32	1	13	18	30	1	13	16	59	4	22	33
P-1	Kalispell	7	0	4	3	10	1	5	4	10	0	6	4	21	1	9	11
P-1	Near Cut Bank	12	0	10	2	14	0	12	2	14	0	12	2	22	0	15	7
P-28	Near Red Lodge	11	0	5	6	16	0	7	9	12	0	5	7	23	0	9	14
P-7	Near Missoula	9	1	3	5	13	1	4	8	14	1	6	7	24	1	10	13
P-5	South of Arlee	10	1	5	4	16	1	6	9	23	2	7	14	48	2	15	31
P-5	Curve Near Ravalli	8	1	3	4	12	1	5	6	11	1	4	6	17	2	6	9
P-8	West of Townsend	13	0	6	7	16	0	6	10	21	0	9	12	32	0	12	20
P-1	Near Havre	9	0	4	5	15	0	6	9	20	0	7	13	38	0	12	26
P-24	Rainbow Bend	5	1	0	4	13	2	2	9	6	1	0	5	17	2	3	12
P-5	Near Polson	11	1	5	5	12	1	6	5	16	1	6	9	25	2	8	15
P-50	Near Big Sky	17	0	6	11	29	0	12	17	18	0	6	12	34	0	13	21
P-14	Deep Creek Canyon	8	0	6	2	8	0	6	2	8	0	6	2	8	0	6	2
P-1	Corum-Hungry Horse	13	0	3	10	17	0	5	12	17	0	4	13	34	0	11	23
P-7	Near Missoula	40	0	17	23	58	1	24	33	61	0	26	35	93	1	38	54
P-6	Plains to Paradise	10	0	5	5	13	0	5	8	11	1	5	5	15	1	5	9
S-205	Bozeman-Belgrade	13	0	8	5	17	0	9	8	15	0	8	7	22	0	12	10
P-82	Big Fork-Somers	11	1	5	5	13	1	7	5	11	1	5	5	16	1	7	8
P-1	Columbia Heights-E	12	0	3	9	15	0	5	10	15	0	5	10	19	0	7	12
SUB-TOTALS BY TYPE OF DELINEATOR																	
	TYPE I	62	2	33	27	87	3	42	42	83	2	42	39	153	6	67	80
	TYPE II	49	3	21	25	72	3	27	42	89	4	33	52	159	5	55	99
	TYPE III	54	2	20	32	79	3	31	45	65	2	22	41	118	4	41	73
	TYPE IV	86	1	38	47	116	2	50	64	113	2	49	62	165	3	69	93
	TOTAL ALL AREAS	251	8	112	131	354	11	150	193	350	10	146	194	595	18	232	345

cp/203G

TABLE III 'AFTER' ACCIDENT DATA

ROUTE	LOCATION-DESCRIPTION	NIGHTTIME RUN-OFF-THE-ROADWAY				RUN-OFF-THE-ROADWAY				NIGHTTIME				ALL ACCIDENTS			
		TOTAL	FATAL	INJ.	P.D.	TOTAL	FATAL	INJ.	P.D.	TOTAL	FATAL	INJ.	P.D.	TOTAL	FATAL	INJ.	P.D.
P-7	Near Missoula	11	0	4	7	12	0	5	7	13	0	6	7	15	0	8	7
P-5	Evaro Hill	12	0	7	5	20	0	11	9	14	0	7	7	24	0	13	11
P-1	Kalispell	6	0	4	2	10	0	6	4	11	0	5	6	18	0	9	9
P-1	Near Cut Bank	7	1	4	2	8	1	4	3	10	1	5	4	15	1	7	7
P-28	Near Red Lodge	0	0	0	0	2	0	0	2	0	0	0	0	6	0	1	5
P-7	Near Missoula	3	0	1	2	6	0	1	5	5	0	2	3	11	0	3	8
P-5	South of Arlee	1	0	1	0	6	0	5	1	3	1	1	1	22	2	9	13
P-5	Curve Near Ravalli	4	0	1	3	6	0	2	4	7	1	2	4	11	1	3	7
P-8	West of Townsend	3	0	1	2	4	0	1	3	4	0	1	3	9	0	2	7
P-1	Near Havre	5	0	3	2	6	0	3	3	6	0	3	3	18	0	6	12
P-24	Rainbow Bend	5	0	2	3	13	0	6	7	6	0	2	4	16	0	6	10
P-5	Near Polson	6	0	2	4	9	0	3	6	9	0	4	5	17	0	6	11
P-50	Near Big Sky	8	0	6	2	18	0	10	8	10	0	7	3	26	0	13	13
P-14	Deep Creek Canyon	2	0	0	2	3	0	0	3	2	0	0	2	3	0	0	3
P-1	Coram-Hungry Horse	13	0	6	7	31	0	14	17	20	2	7	11	58	2	24	32
P-7	Near Missoula	24	1	11	12	35	1	13	21	37	2	15	20	55	2	21	32
P-6	Plains to Paradise	5	1	4	0	7	1	4	2	7	1	4	2	13	1	6	6
S-205	Bozeman-Belgrade	6	0	4	2	9	0	6	3	6	0	4	2	11	1	6	4
P-82	Big Fork-Somers	3	0	2	1	4	0	3	1	3	0	2	1	6	0	4	2
P-1	Columbia Heights-E.	8	1	5	3	11	1	6	4	9	1	5	3	18	1	7	10
SUB-TOTALS BY TYPE OF DELINEATOR																	
	TYPE I	36	1	19	16	52	1	26	25	48	1	23	24	78	1	38	39
	TYPE II	16	0	7	9	28	0	12	16	25	2	9	14	71	3	23	47
	TYPE III	34	0	16	18	65	0	29	41	47	2	20	25	120	2	49	69
	TYPE IV	46	3	26	18	66	3	32	21	62	4	30	28	103	5	44	54
	TOTAL ALL AREAS	132	4	68	61	211	4	99	113	182	9	82	91	372	11	154	209

cp/203K

TABLE IV ACCIDENT RATES

TYPE OF DELINEATOR	NIGHT-TIME-RUN-OFF-ROAD			RUN-OFF-THE-ROAD			NIGHT-TIME			ALL ACCIDENTS		
	BEFORE	AFTER	% CHANGES	BEFORE	AFTER	% CHANGE	BEFORE	AFTER	% CHANGE	BEFORE	AFTER	% CHANG
I	2.09	1.83	-12%	2.93	2.65	-10%	2.80	2.44	-13%	5.16	3.97	-23%
II	1.59	0.78	-51%	2.33	1.36	-42%	2.88	1.22	-58%	5.15	3.45	-33%
III	2.76	1.99	-28%	4.04	3.84	- 6%	3.33	2.76	-17%	6.04	7.05	+16%
IV	2.78	1.86	-35%	3.76	2.58	-31%	3.66	2.42	-34%	5.34	4.03	-25%
ALL	2.23	1.56	-30%	3.15	2.51	-20%	3.11	2.16	-31%	5.29	4.42	-16%

POISSON TEST
OF
STATISTICAL SIGNIFICANCE

** DELINEATOR TYPE I **

ACCIDENT GROUP	PERCENT REDUCTION OF ACC.	80% LEVEL OF CONFIDENCE	IS THIS SIGNIFICANT YES/NO
NIGHTTIME RUN-OFF-THE-ROAD	12	11	yes
RUN-OFF-THE-ROADWAY	10	10	yes
NIGHTTIME	13	10	no
ALL ACCIDENTS	23	6	yes

** DELINEATOR TYPE II **

ACCIDENT GROUP	PERCENT REDUCTION OF ACC.	80% LEVEL OF CONFIDENCE	IS THIS SIGNIFICANT YES/NO
NIGHTTIME RUN-OFF-THE-ROAD	51	12.5	yes
RUN-OFF-THE-ROADWAY	42	10.5	yes
NIGHTTIME	58	10	yes
ALL ACCIDENTS	33	5	yes

** DELINEATOR TYPE III **

ACCIDENT GROUP	PERCENT REDUCTION OF ACC.	80% LEVEL OF CONFIDENCE	IS THIS SIGNIFICANT YES/NO
NIGHTTIME RUN-OFF-THE-ROAD	28	12	yes
RUN-OFF-THE-ROADWAY	6	10.5	no
NIGHTTIME	17	11	yes
ALL ACCIDENTS	+16	7.5	no

** DELINEATOR TYPE IV **

ACCIDENT GROUP	PERCENT REDUCTION OF ACC.	80% LEVEL OF CONFIDENCE	IS THIS SIGNIFICANT YES/NO
NIGHTTIME RUN-OFF-THE-ROAD	35	10	yes
RUN-OFF-THE-ROADWAY	31	7.5	yes
NIGHTTIME	34	8	yes
ALL ACCIDENTS	25	5	yes

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POISSON TEST
OF
STATISTICAL SIGNIFICANCE

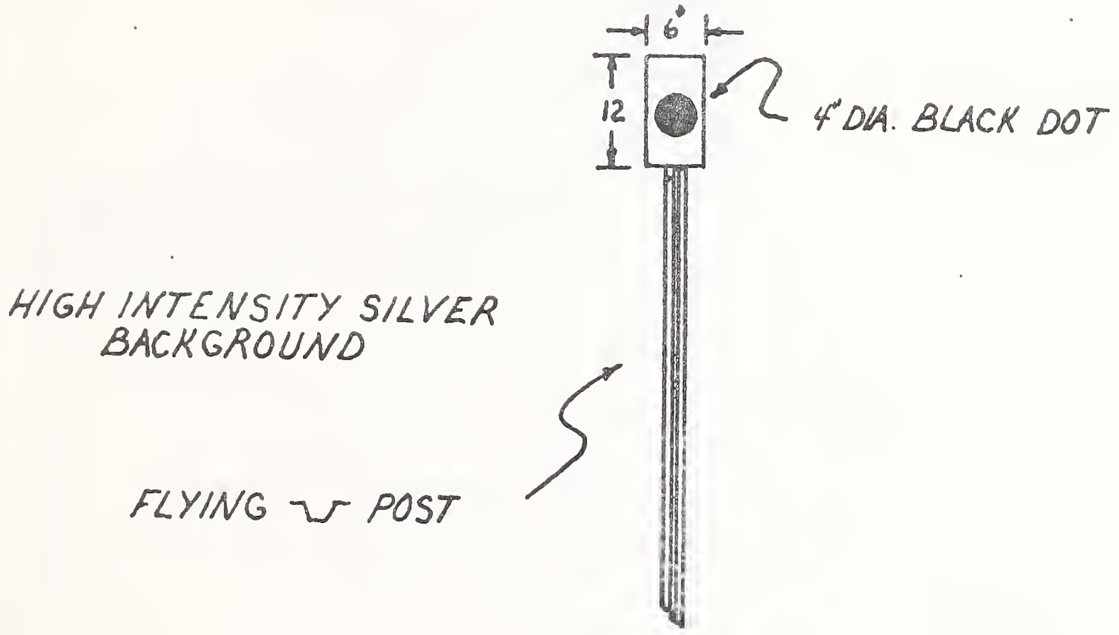
ALL DELINEATORS

ACCIDENT GROUP	PERCENT REDUCTION OF ACC.	80% LEVEL OF CONFIDENCE	IS THIS SIGNIFICANT YES/NO
NIGHTTIME RUN-OFF-THE-ROADWAY	30	4	yes
RUN-OFF-THE-ROADWAY	20	3	yes
NIGHTTIME	31	2	yes
ALL ACCIDENTS	16	1	yes

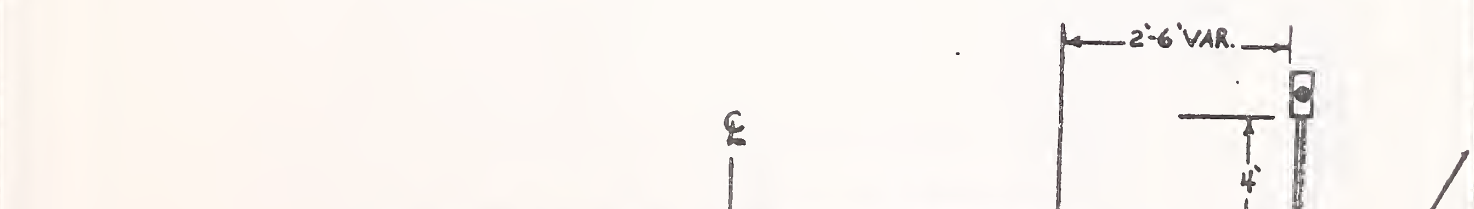
CWM:dj:cp:203B2

TYPICAL DETAILS

TYPE I DESIGN



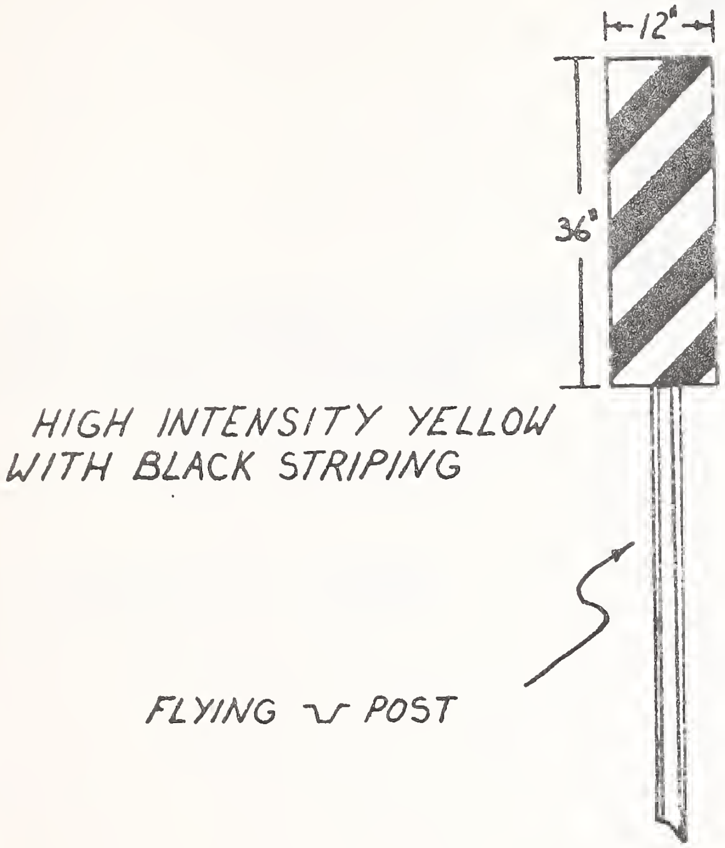
TYPICAL DELINEATOR PLACEMENT



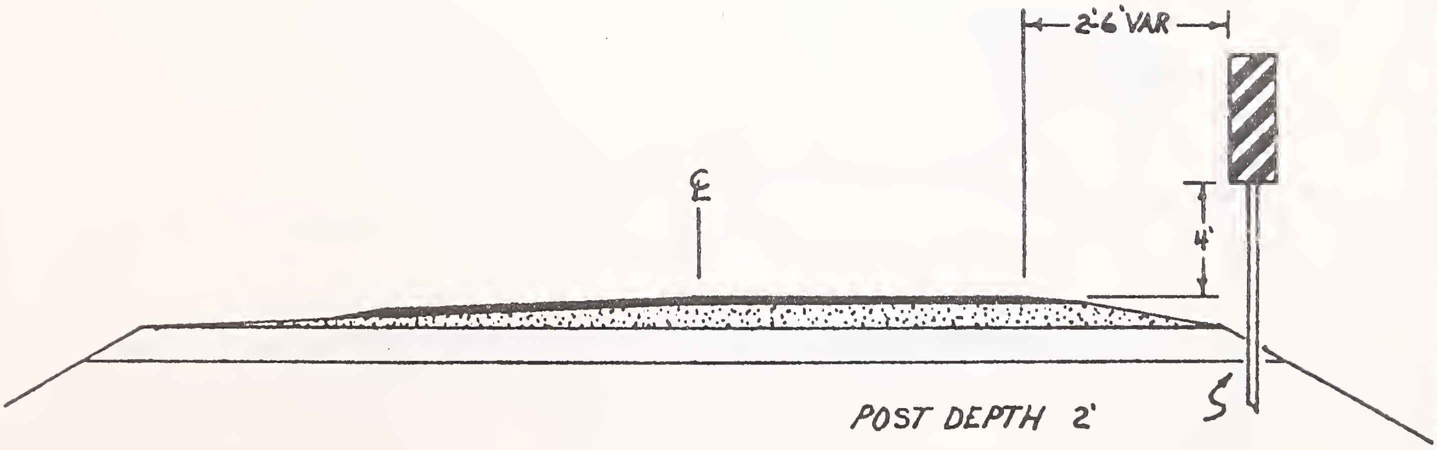
DRAWING NOT TO SCALE

4-79

TYPE II DESIGN

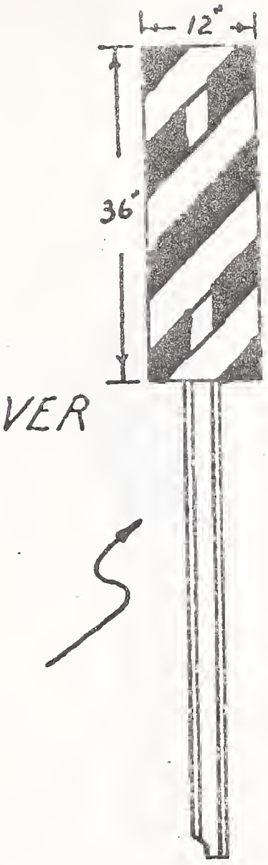


TYPICAL DELINEATOR PLACEMENT



DRAWING NOT TO SCALE
4-79

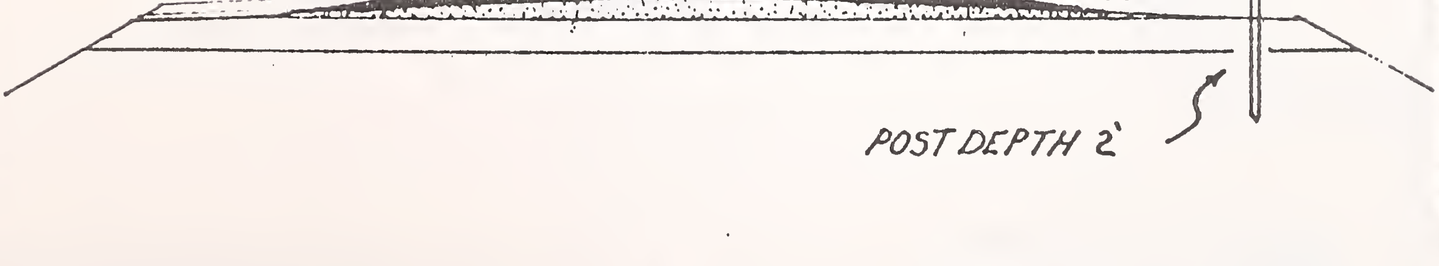
TYPE III DESIGN



HIGH INTENSITY SILVER
WITH BLACK STRIPING

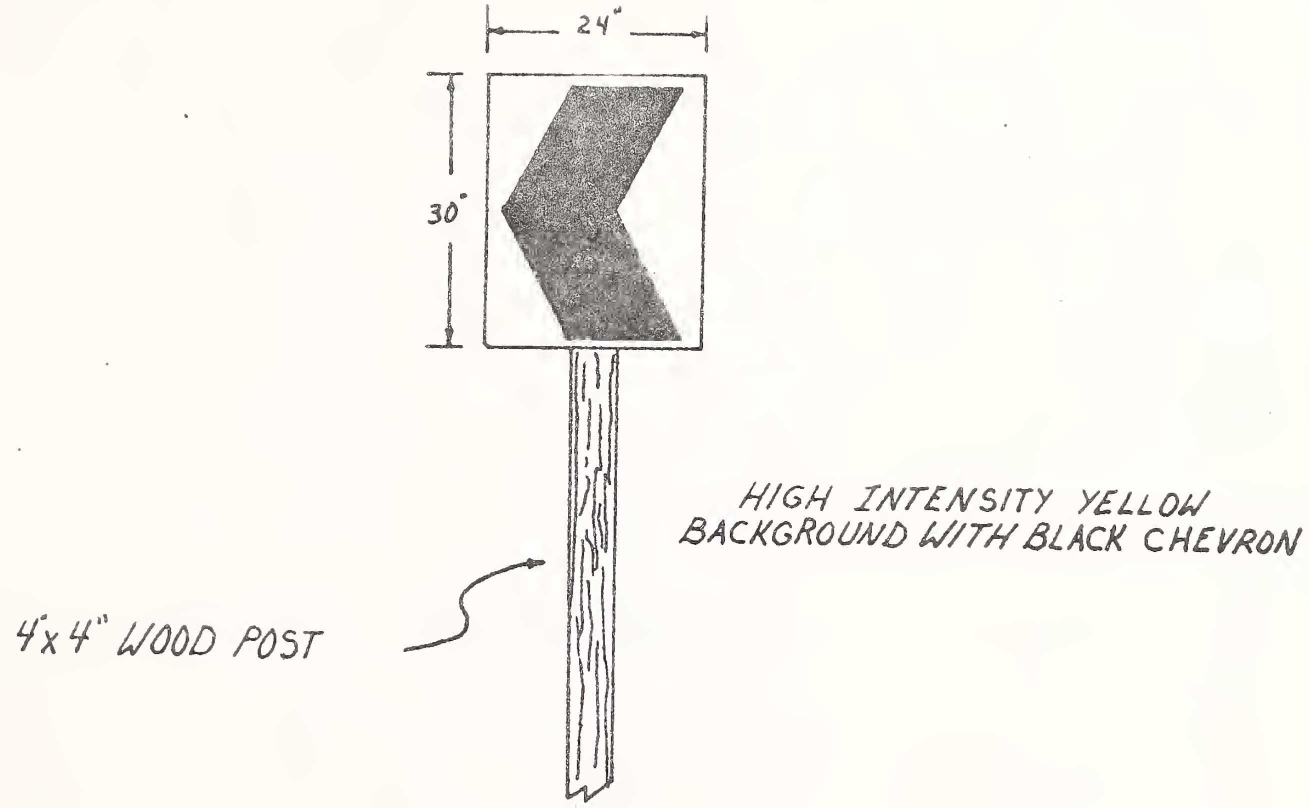
FLYING V POST

TYPICAL DELINEATOR PLACEMENT



DRAWING NOT TO SCALE
4-79

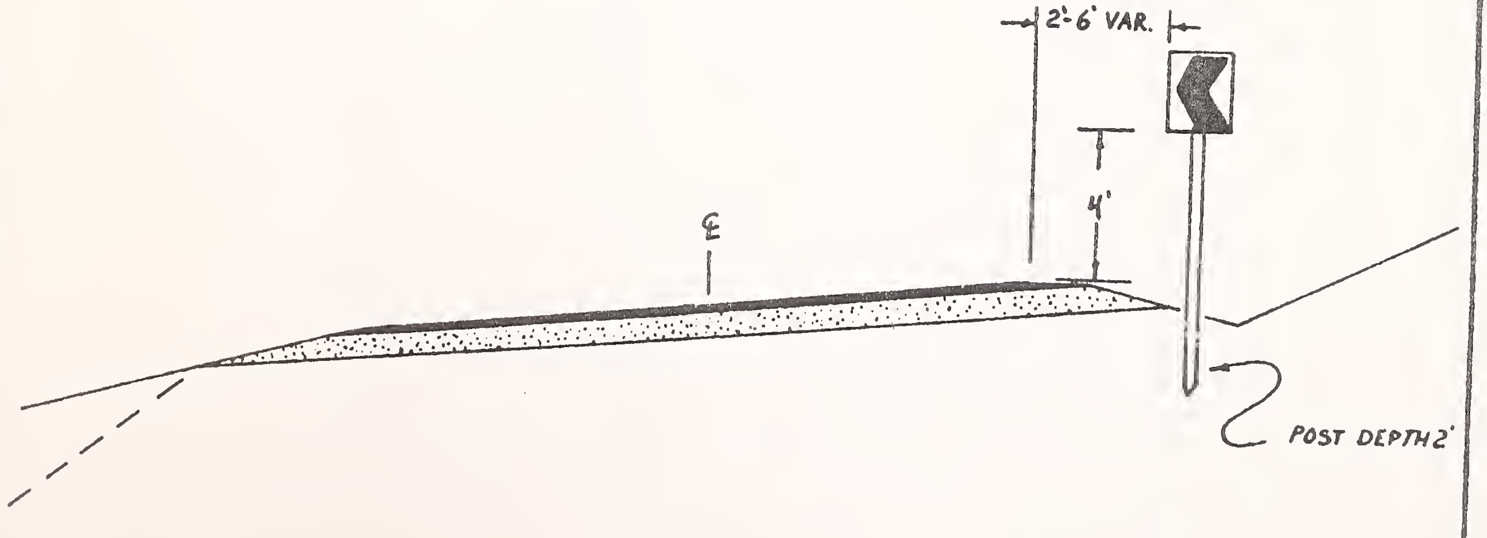
TYPE IV DESIGN



HIGH INTENSITY YELLOW BACKGROUND WITH BLACK CHEVRON

4"x 4" WOOD POST

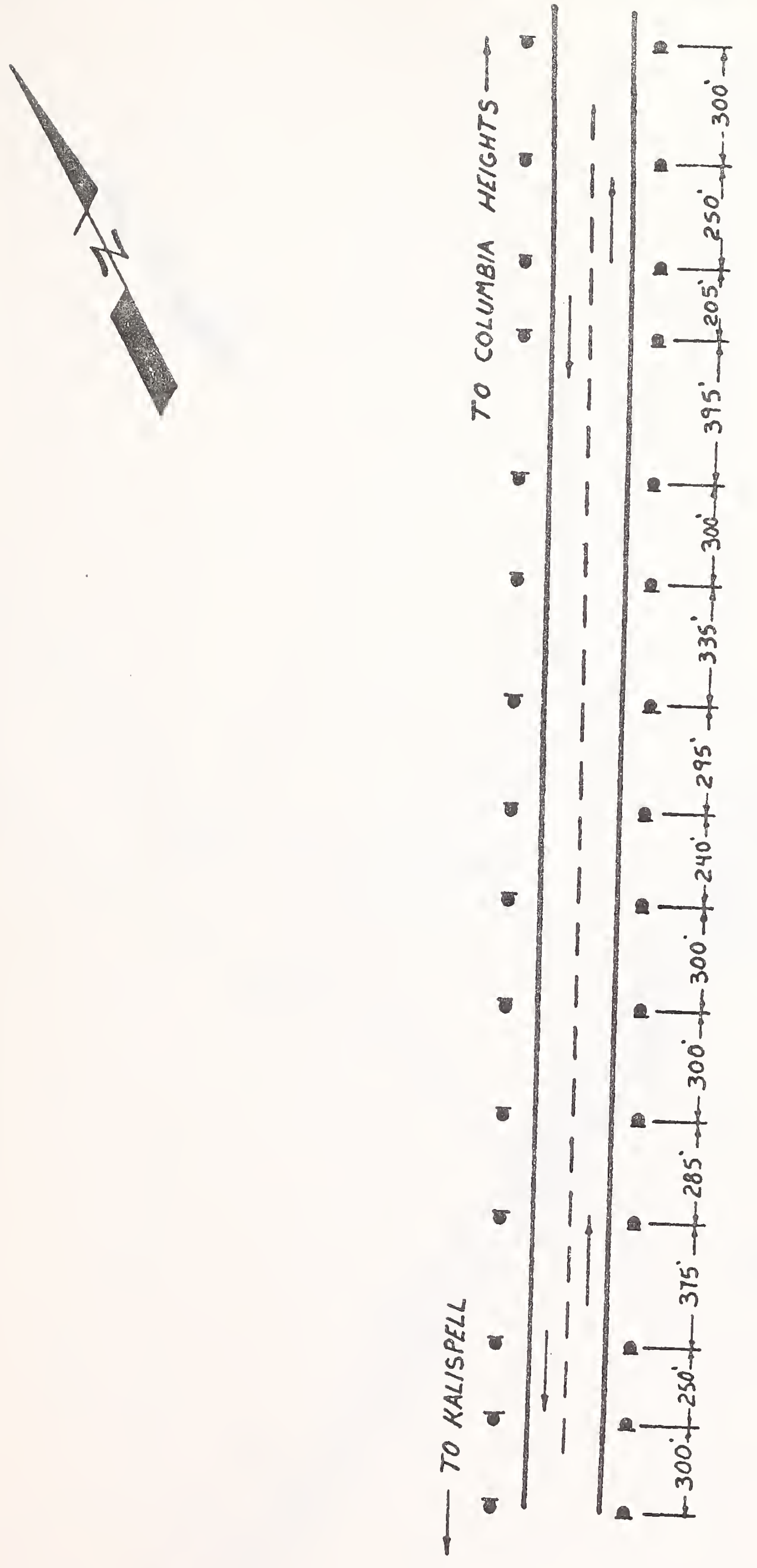
TYPICAL DELINEATOR PLACEMENT



POST DEPTH 2'

DRAWING NOT TO SCALE
4-79

LOCATION PLANS

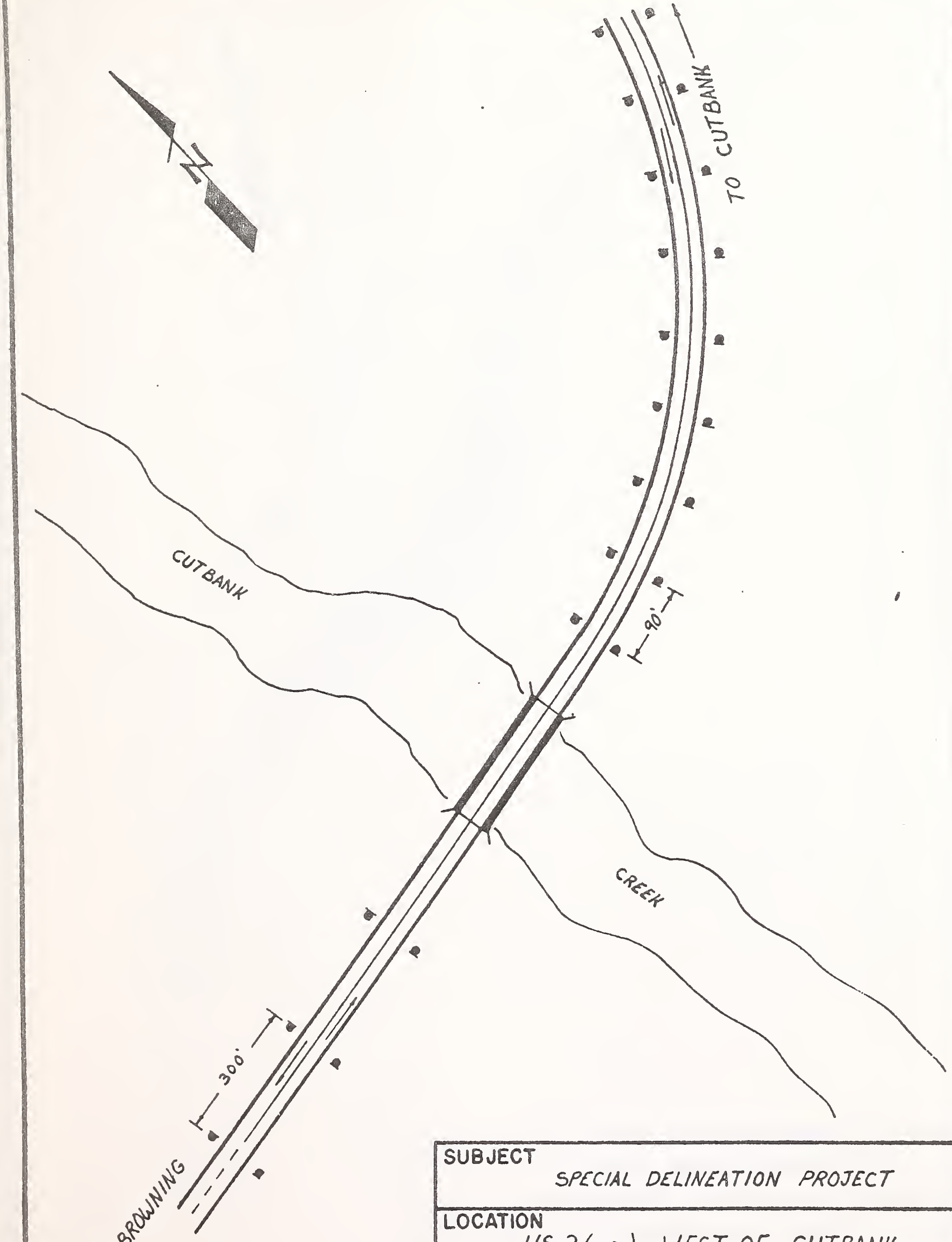


SUBJECT
SPECIAL DELINEATION PROJECT

LOCATION
U.S. 2 (FAP 1) KALISPELL NORTH

MILE MARKER
FROM : 139.0
TO : 139.7

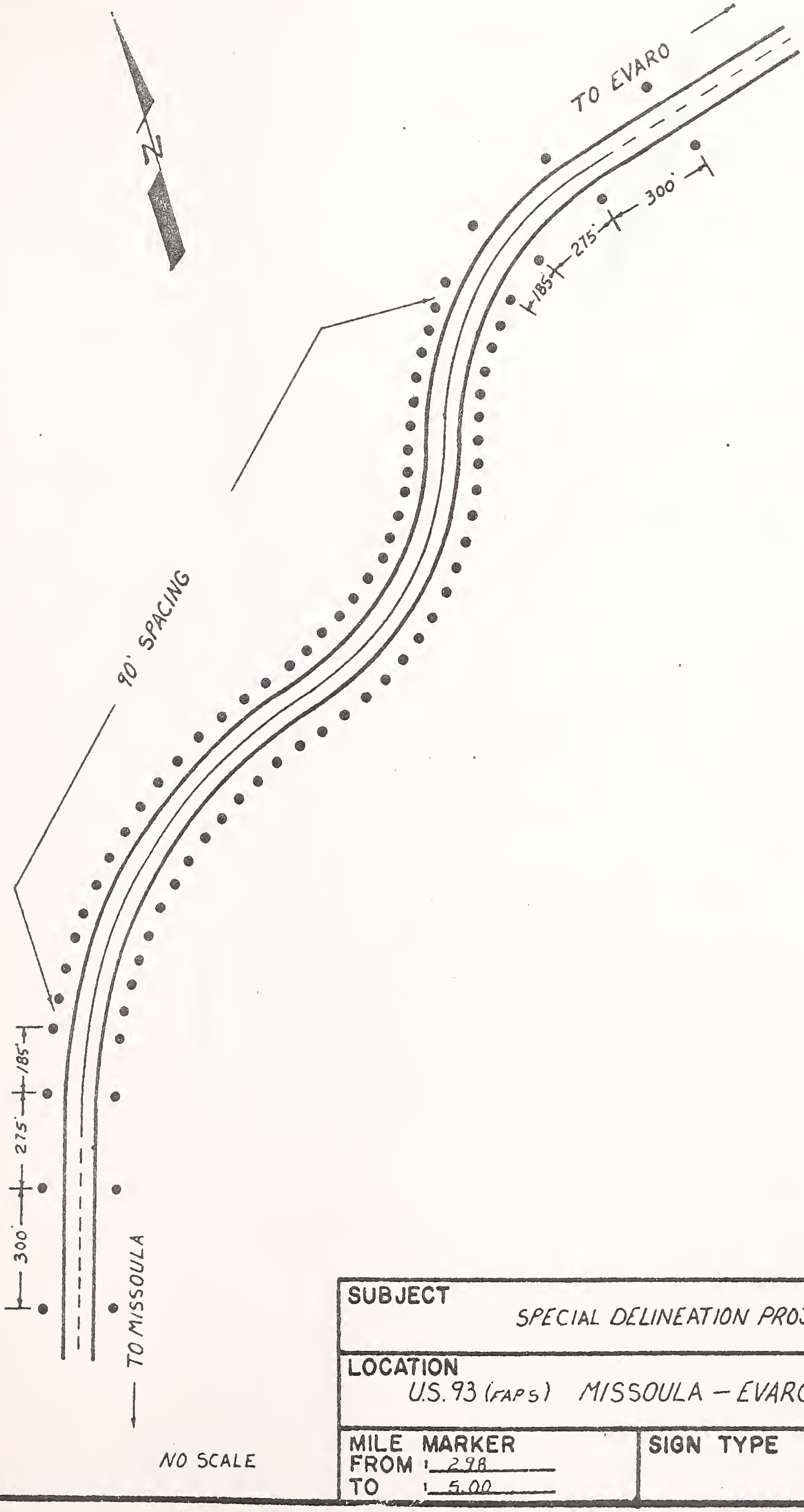
SIGN TYPE
I



SUBJECT
SPECIAL DELINEATION PROJECT

LOCATION
U.S. 2 (FAP1) WEST OF CUTBANK

MILE MARKER FROM : 253.8 TO : 254.4	SIGN TYPE I

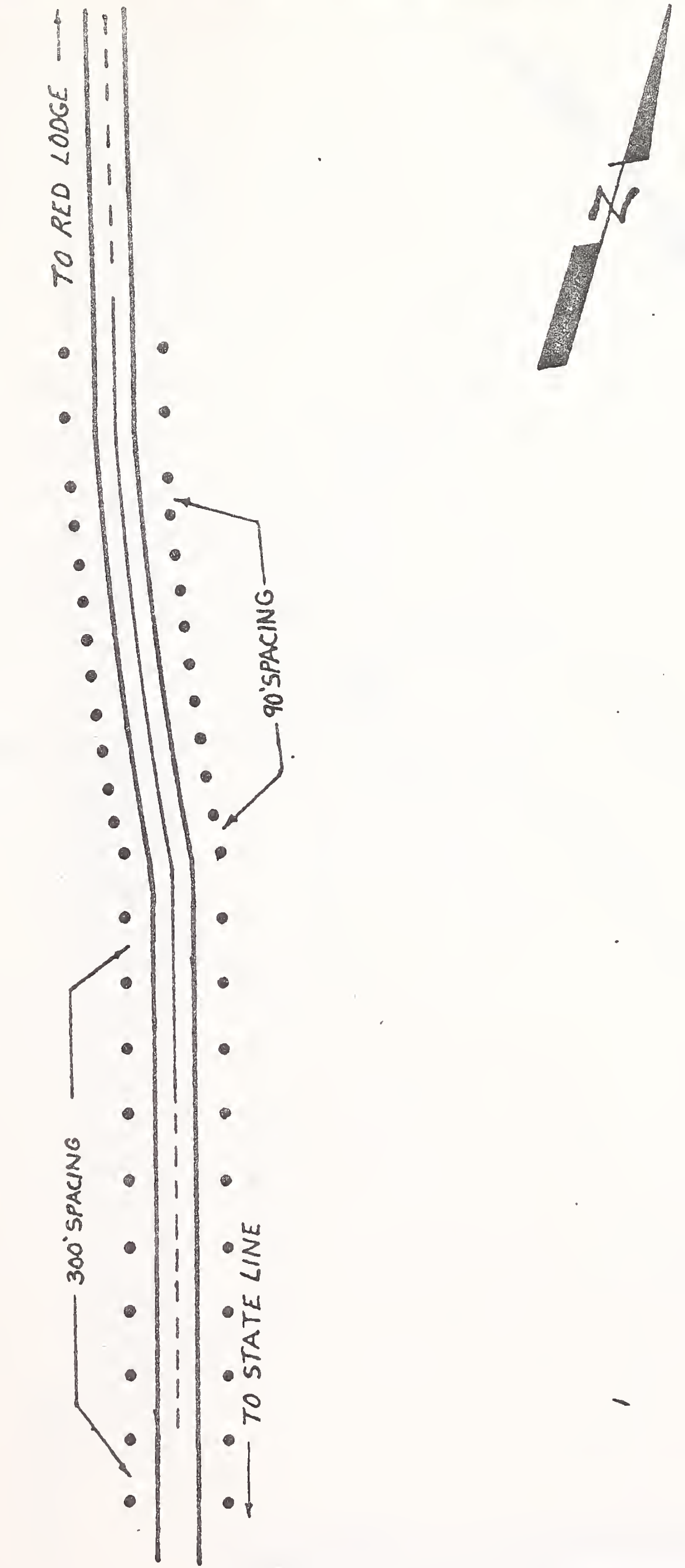


SUBJECT
SPECIAL DELINEATION PROJECT

LOCATION
U.S. 93 (FAP 5) MISSOULA – EVARO

MILE MARKER
FROM : 2.98
TO : 5.00

SIGN TYPE
I

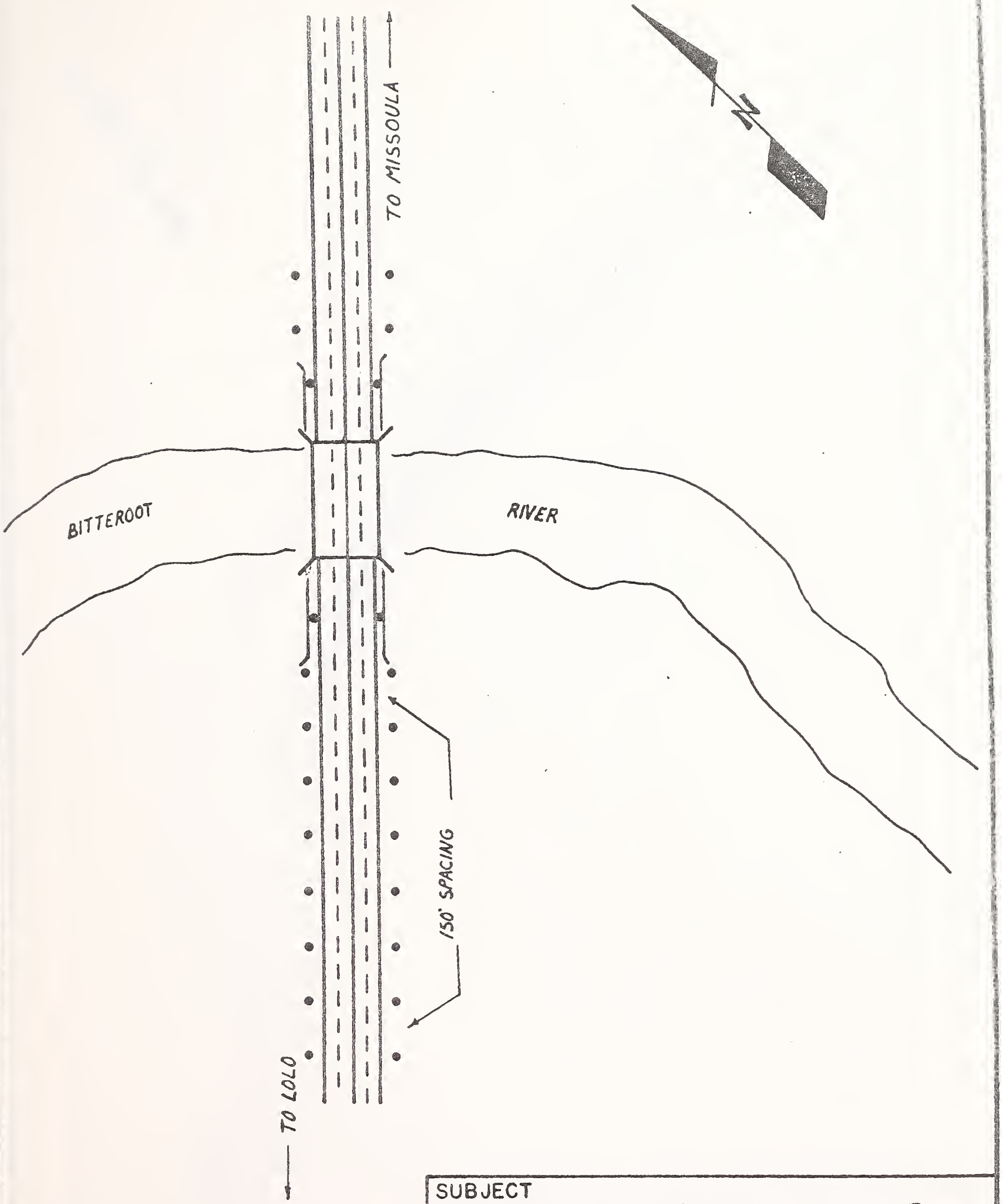


SUBJECT
SPECIAL DELINEATION PROJECT

LOCATION
U.S. 212 (FAP 28) NEAR RED LODGE

MILE MARKER FROM : 70.28 TO : 71.0	SIGN TYPE I

NO SCALE



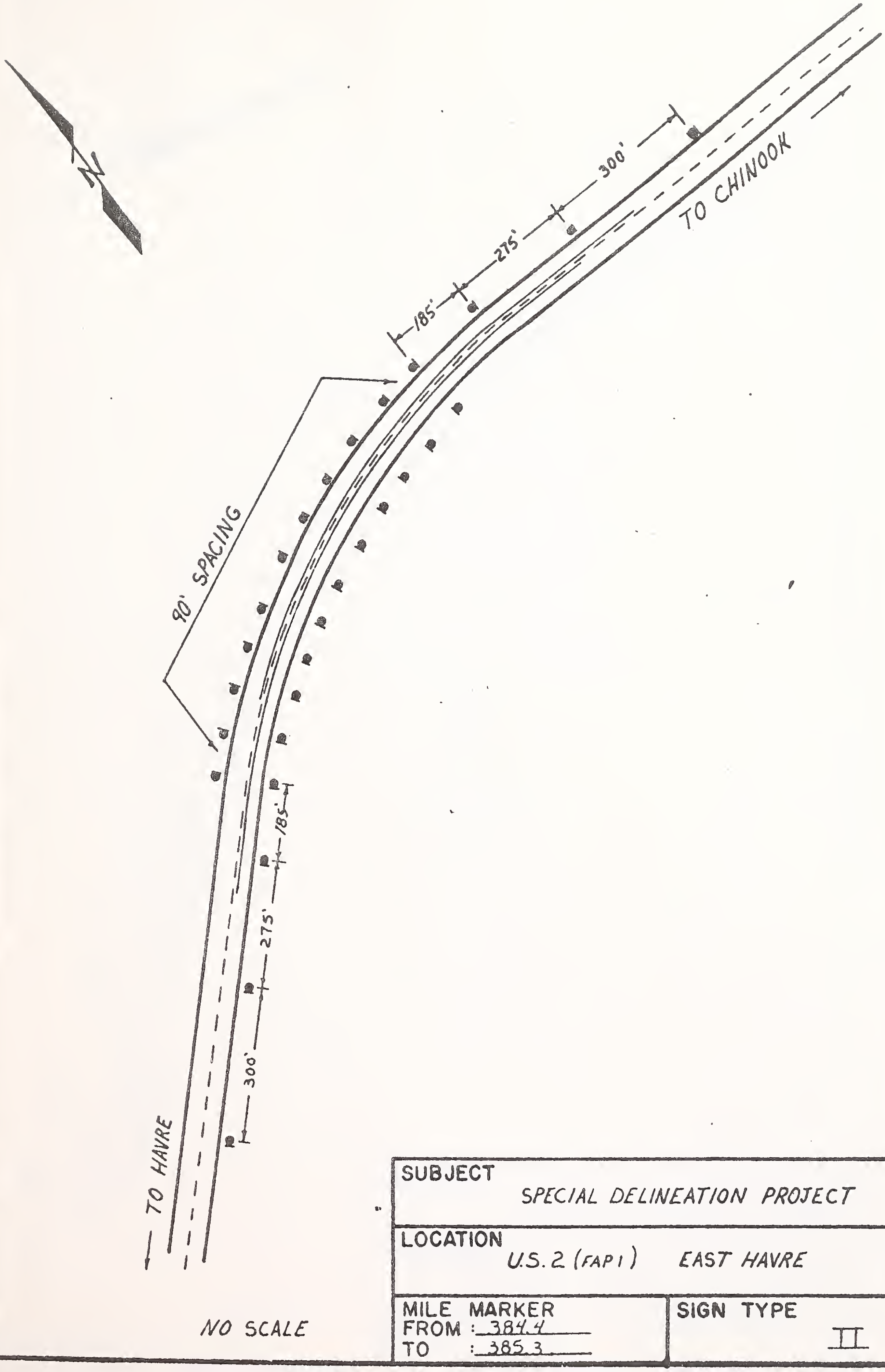
NO SCALE

SUBJECT
SPECIAL DELINEATION PROJECT

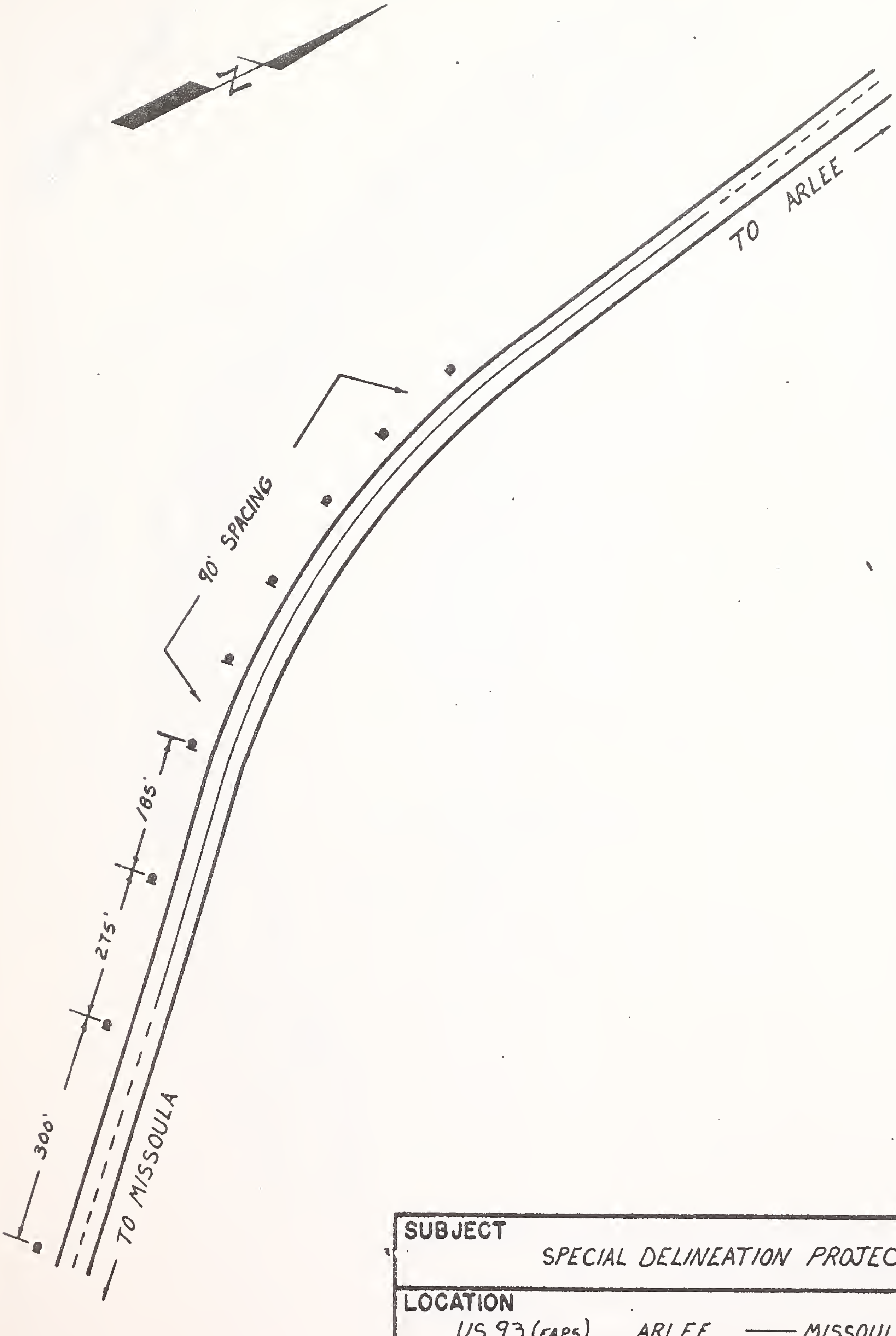
LOCATION
U.S. 93 (FAP 7) MISSOULA — LOLO

MILE MARKER
FROM : 89.6
TO : 90.2

SIGN TYPE
I



SUBJECT SPECIAL DELINEATION PROJECT	
LOCATION U.S. 2 (FAP 1) EAST HAVRE	
MILE MARKER FROM : 384.4 TO : 385.3	**SIGN TYPE** II



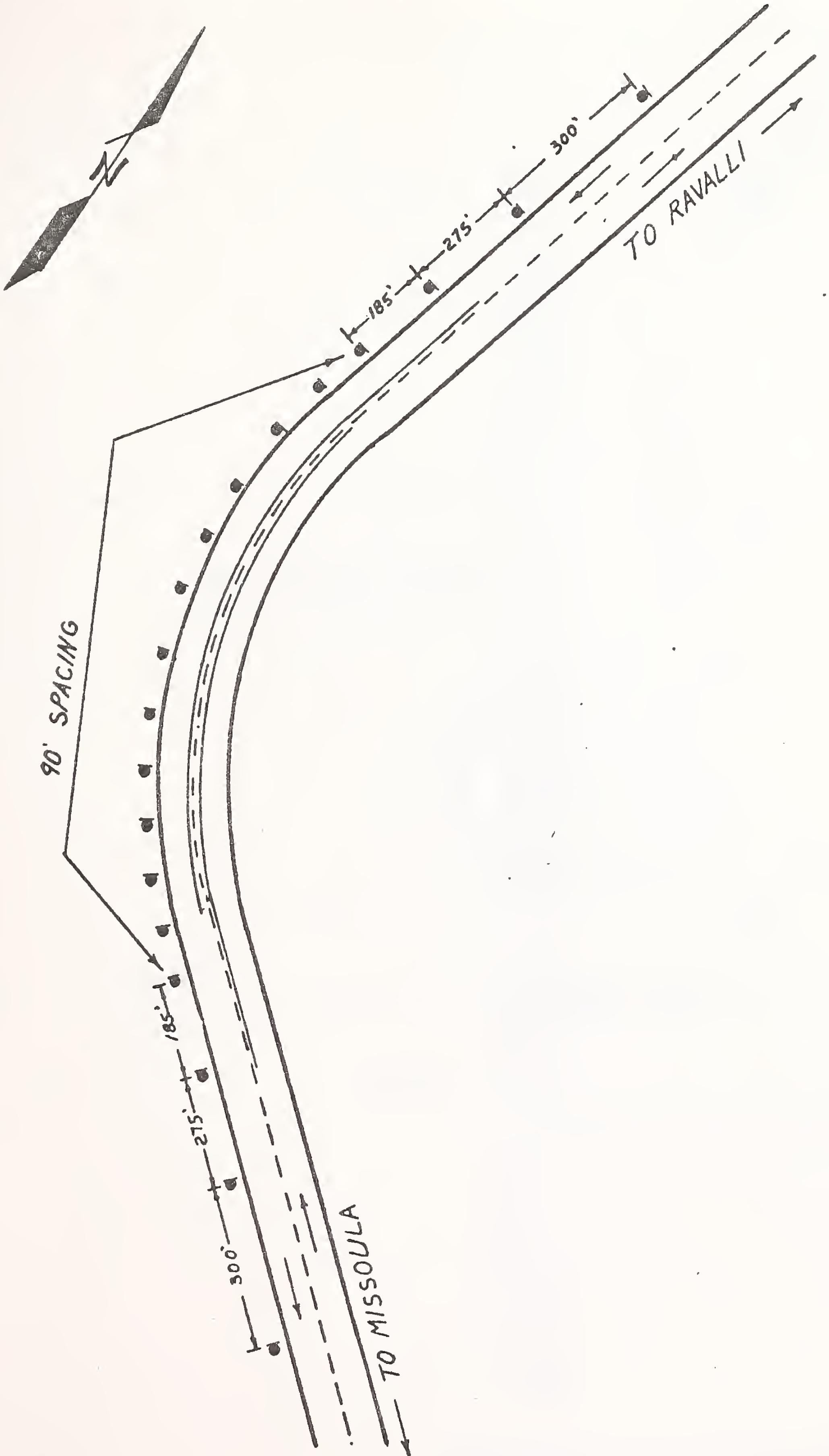
NO SCALE

SUBJECT
SPECIAL DELINEATION PROJECT

LOCATION
US.93 (FAPS) ARLEE —— MISSOULA

MILE MARKER
FROM : 171
TO : 176

SIGN TYPE
II



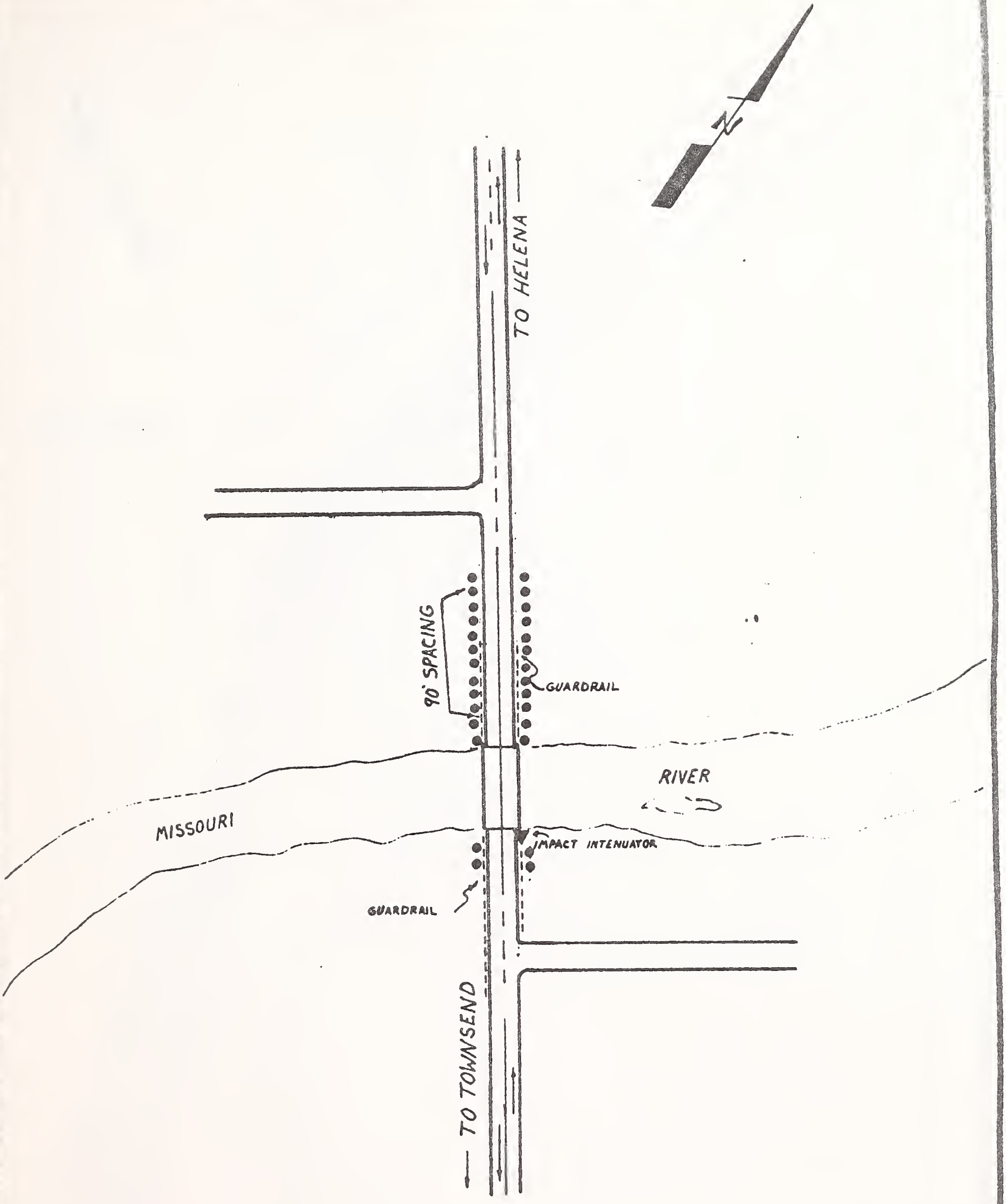
NO SCALE

SUBJECT
SPECIAL DELINEATION PROJECT

LOCATION
U.S. 93. (FAP 5) MISSOULA — RAVALLI

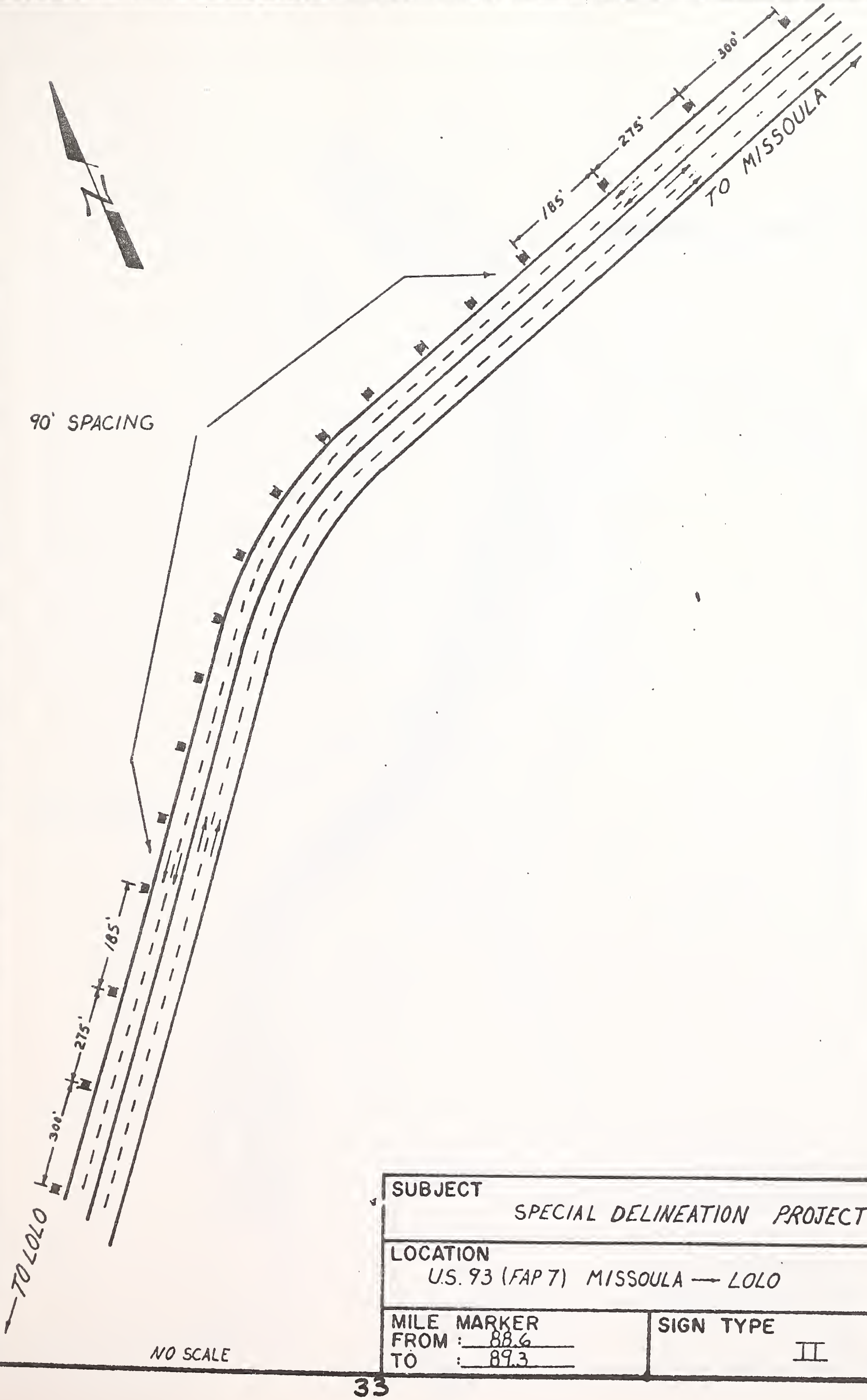
MILE MARKER
FROM : 24.7
TO : 25.7

SIGN TYPE
II



SUBJECT SPECIAL DELINEATOR PROJECT	
LOCATION U.S. 12 (FAP 8) TOWNSEND – HELENA	
MILE MARKER FROM : 75.8 TO : 76.4	SIGN TYPE II

NO SCALE

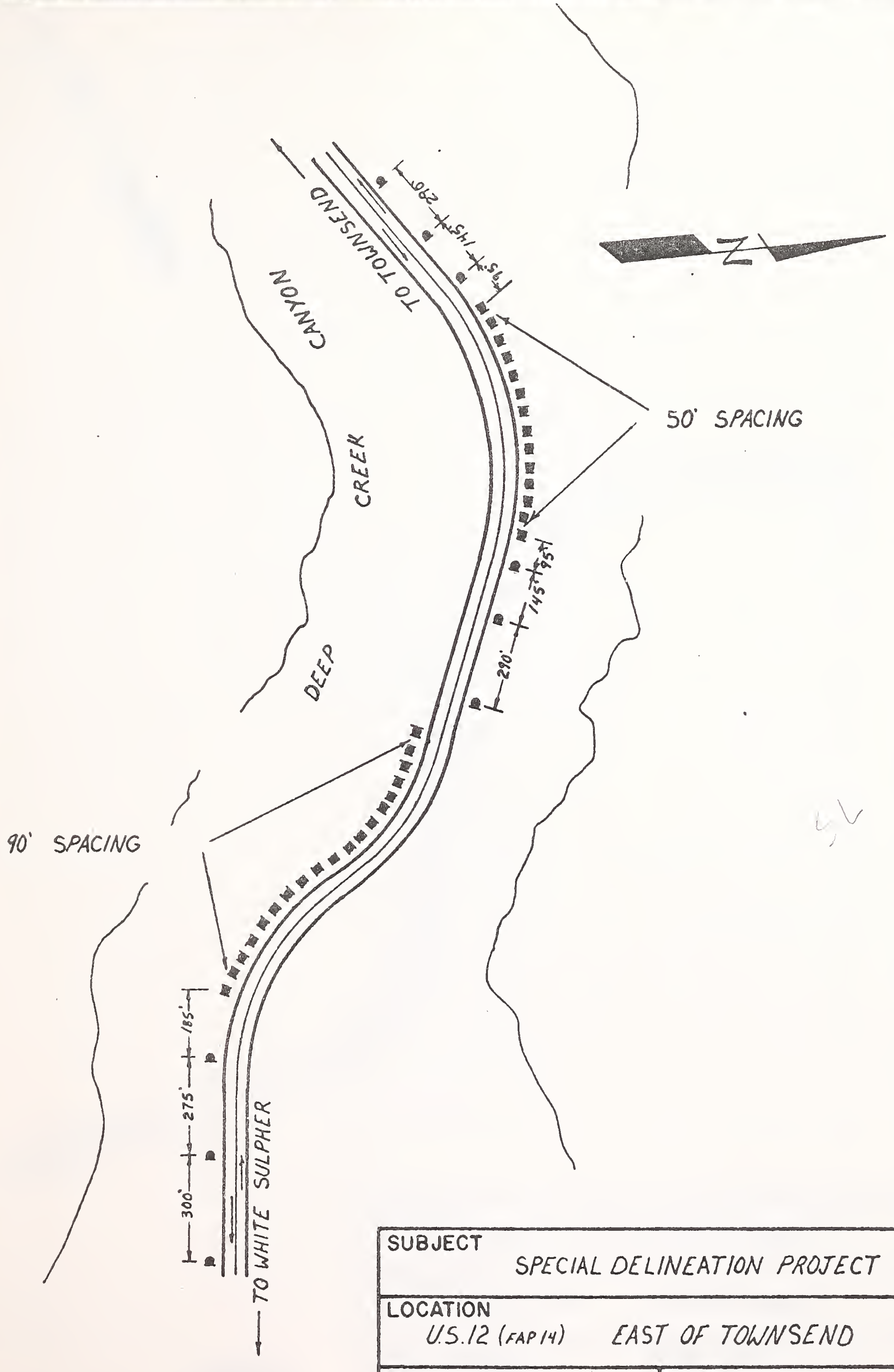


SUBJECT
SPECIAL DELINEATION PROJECT

LOCATION
U.S. 93 (FAP 7) MISSOULA — LOLO

MILE MARKER
FROM : 88.6
TO : 89.3

SIGN TYPE
II

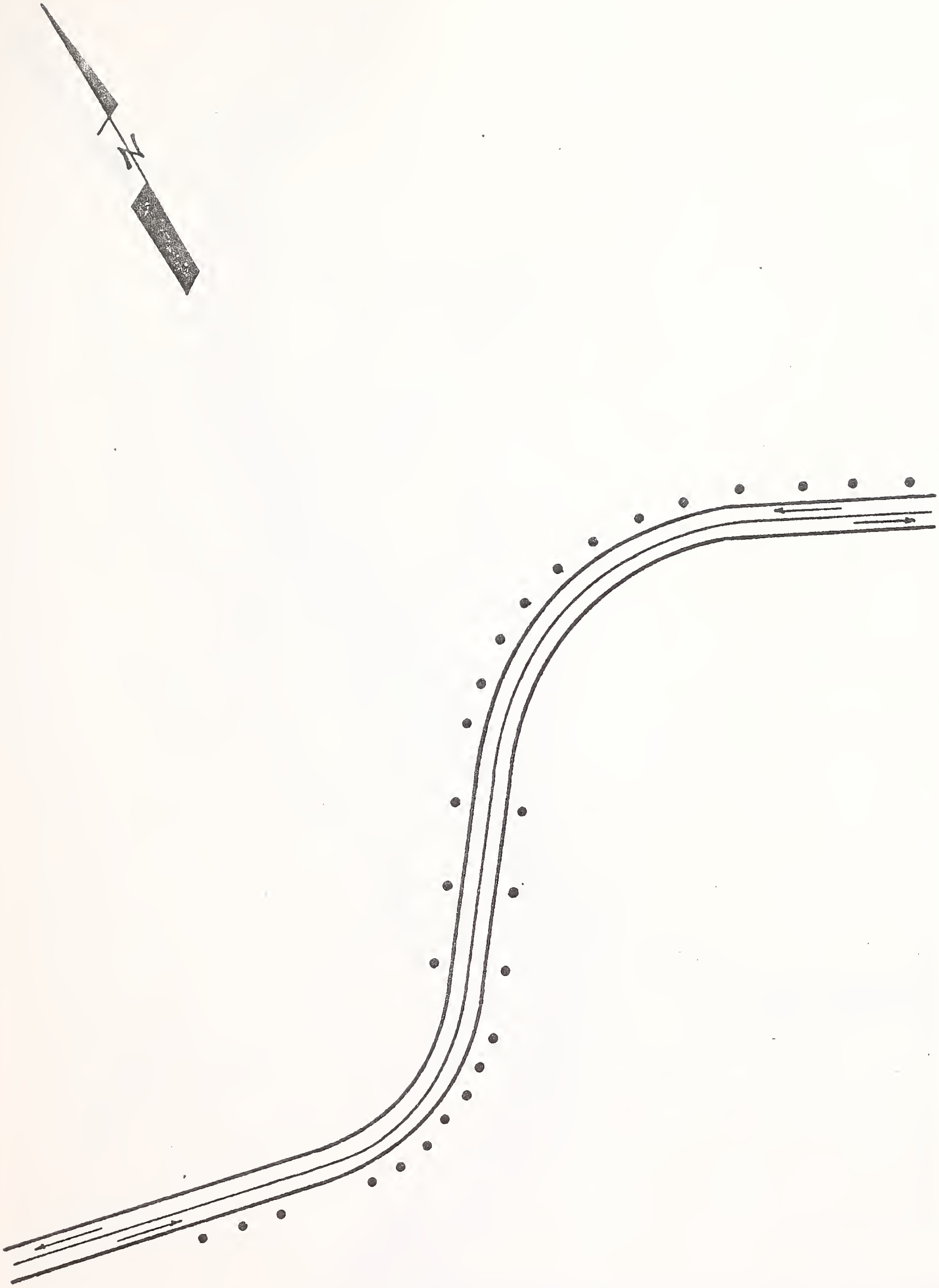


SUBJECT
SPECIAL DELINEATION PROJECT

LOCATION
U.S. 12 (FAP 14) EAST OF TOWNSEND

MILE MARKER
FROM : 8.3
TO : 9.1

SIGN TYPE
III



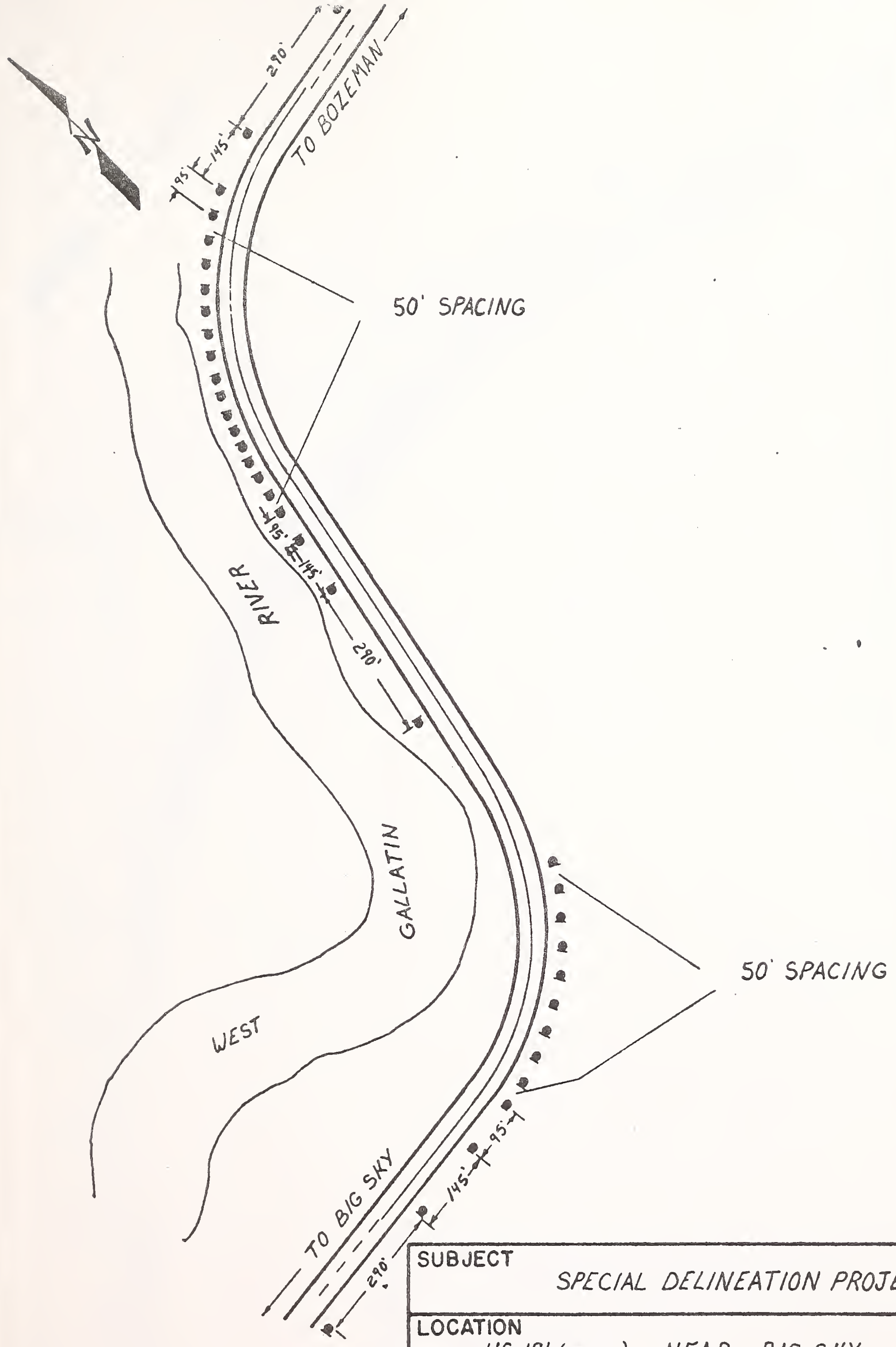
NO SCALE

SUBJECT
SPECIAL DELINEATION PROJECT

LOCATION
US 2 (FAP1) HUNGRY HORSE

MILE MARKER
FROM : 142.3
TO : 143.9

SIGN TYPE
III

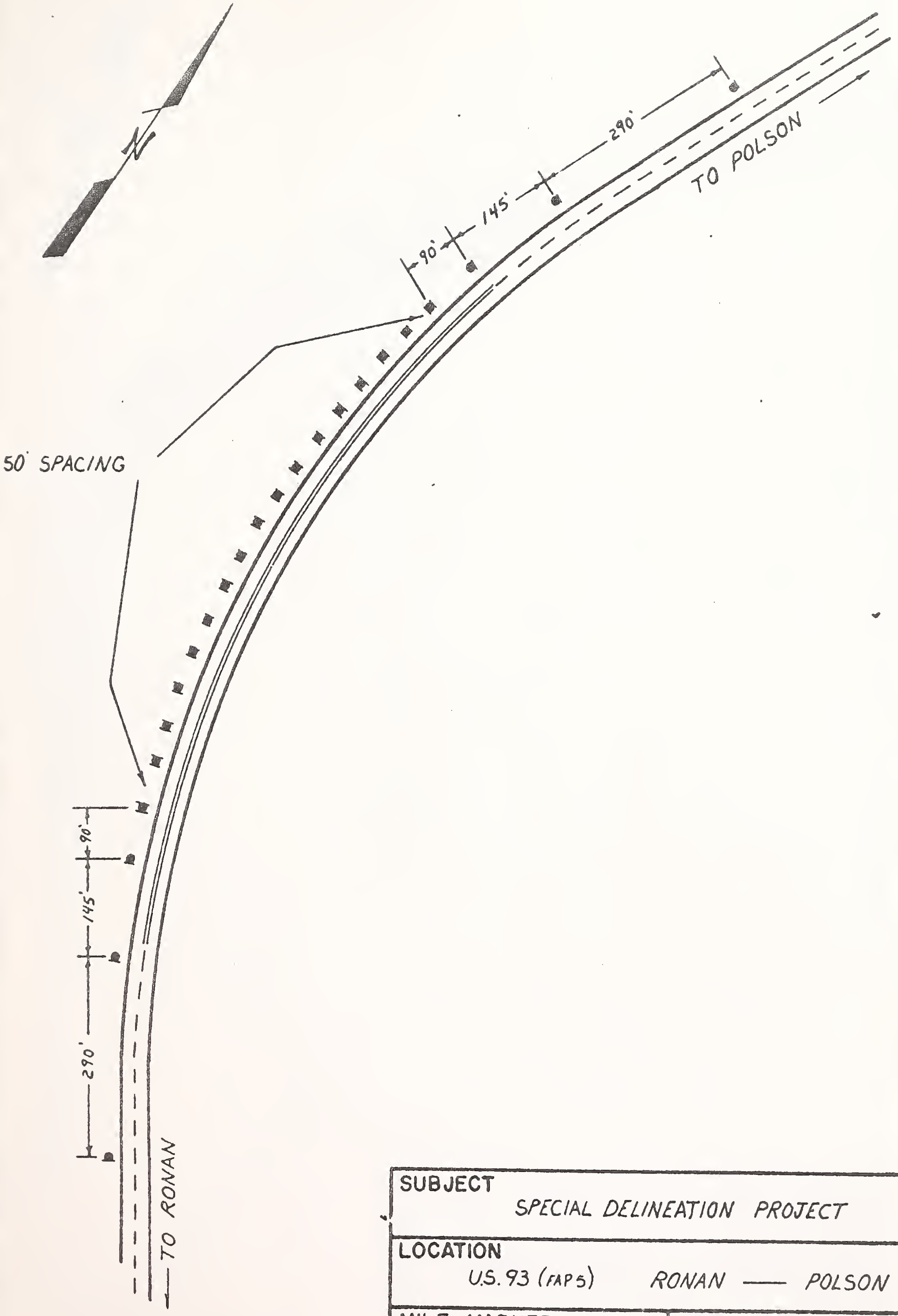


SUBJECT
SPECIAL DELINEATION PROJECT

LOCATION
US. 191 (FAP 50) NEAR BIG SKY

MILE MARKER
FROM : 50.4
TO : 51.1

SIGN TYPE
III



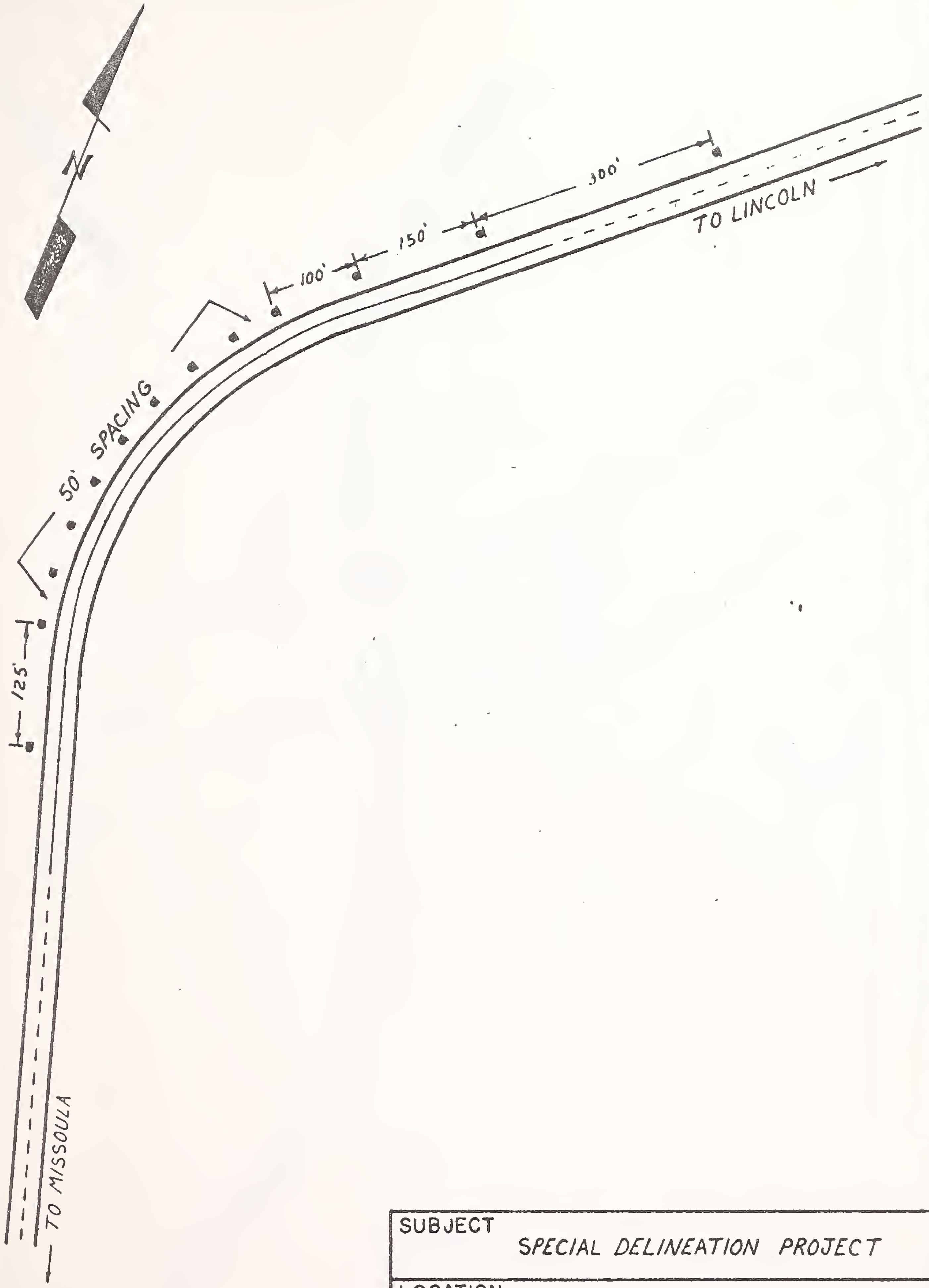
SUBJECT
SPECIAL DELINEATION PROJECT

LOCATION
U.S. 93 (FAP 5) RONAN — POLSON

MILE MARKER
FROM : 56.4
TO : 57.2

SIGN TYPE
III

NO SCALE



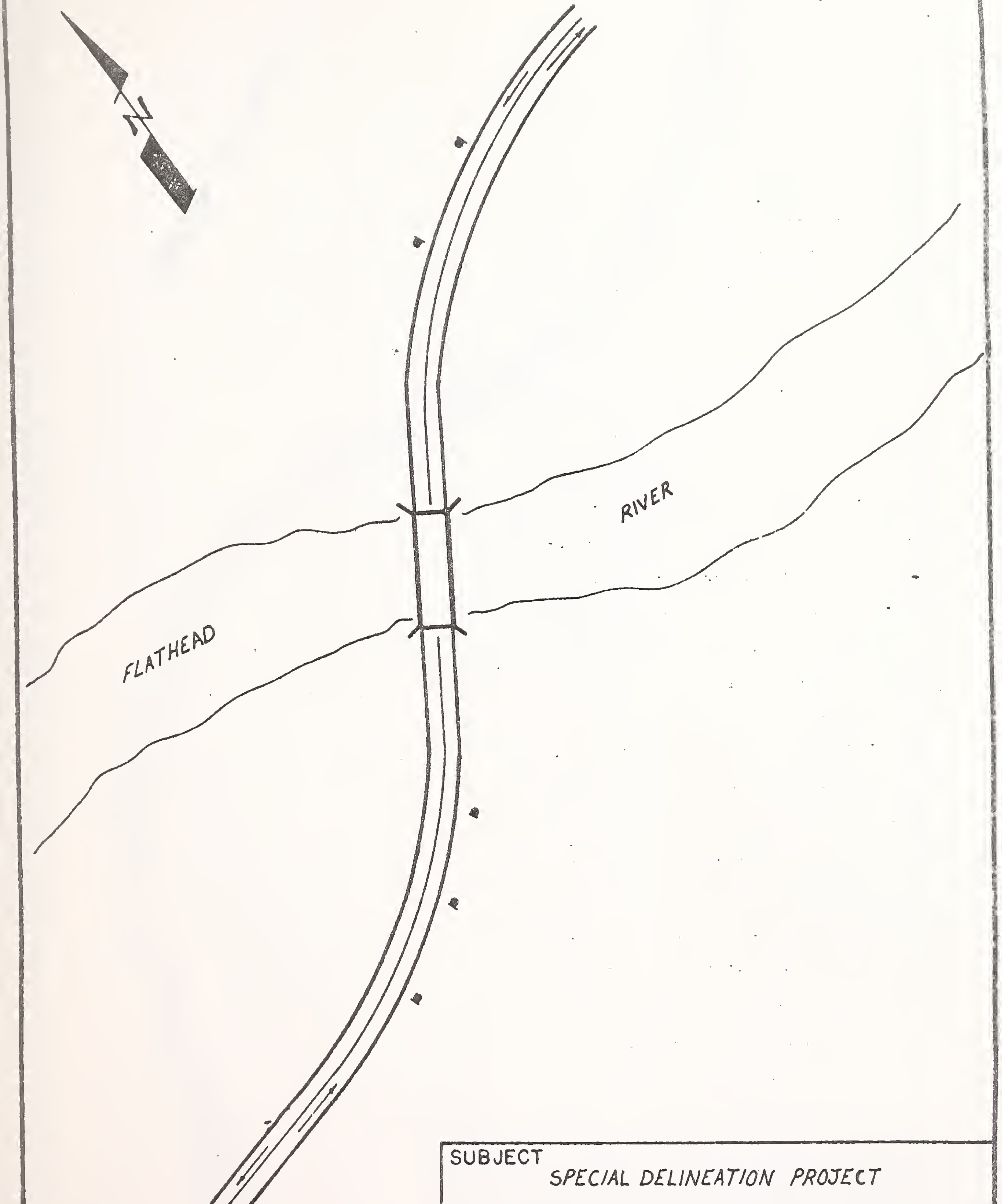
NO SCALE

SUBJECT
SPECIAL DELINEATION PROJECT

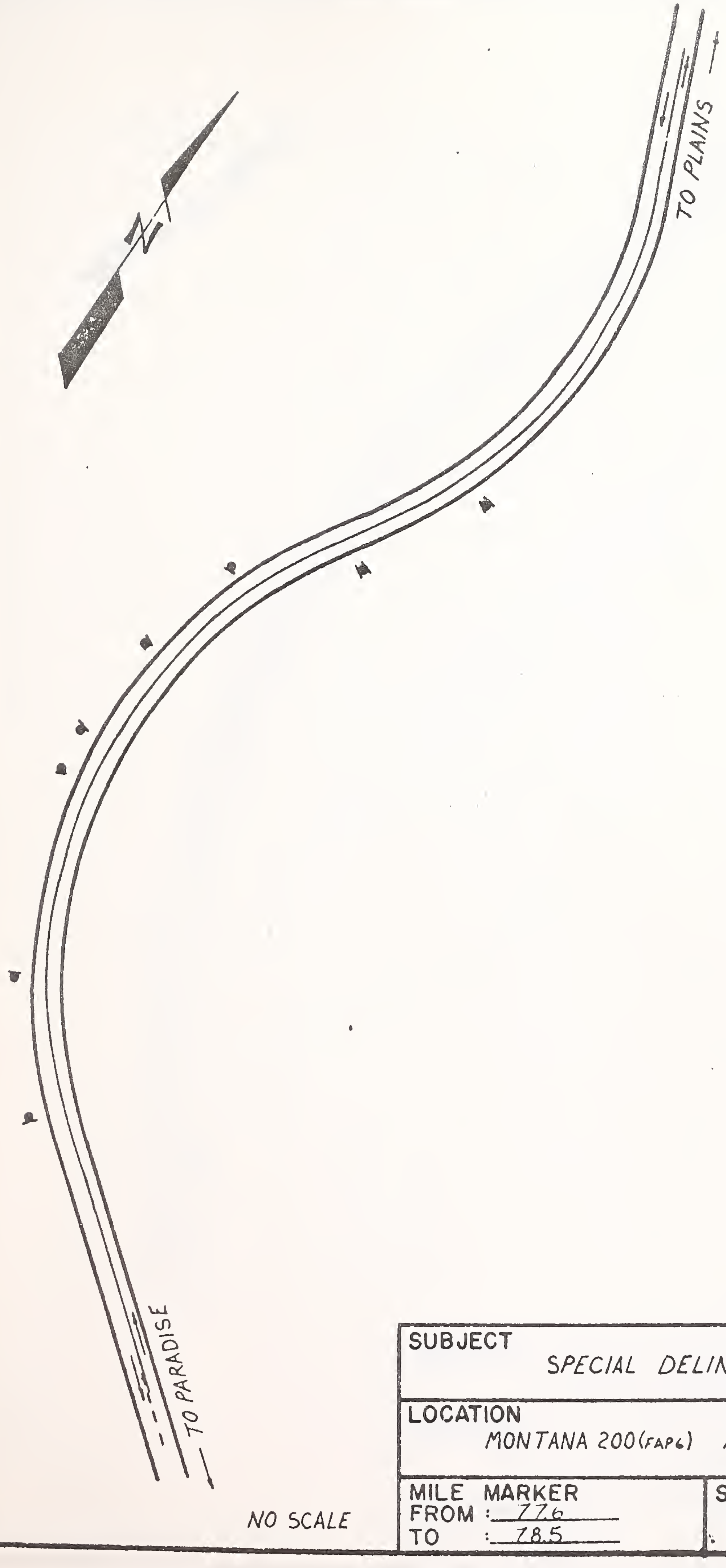
LOCATION
MONTANA 200 (FAP 24) RAINBOW BEND

MILE MARKER
FROM : 8.5
TO : 9.0

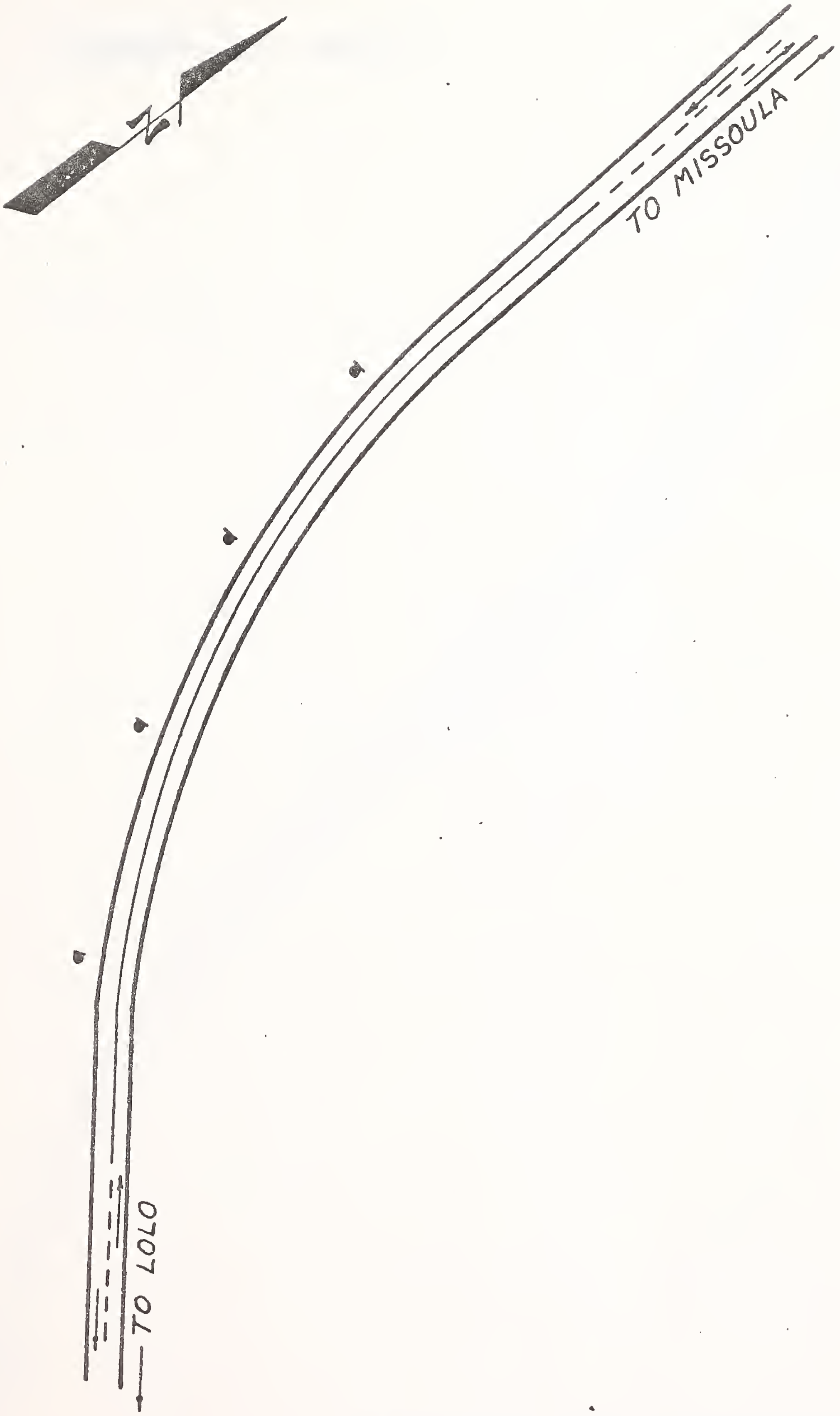
SIGN TYPE
III



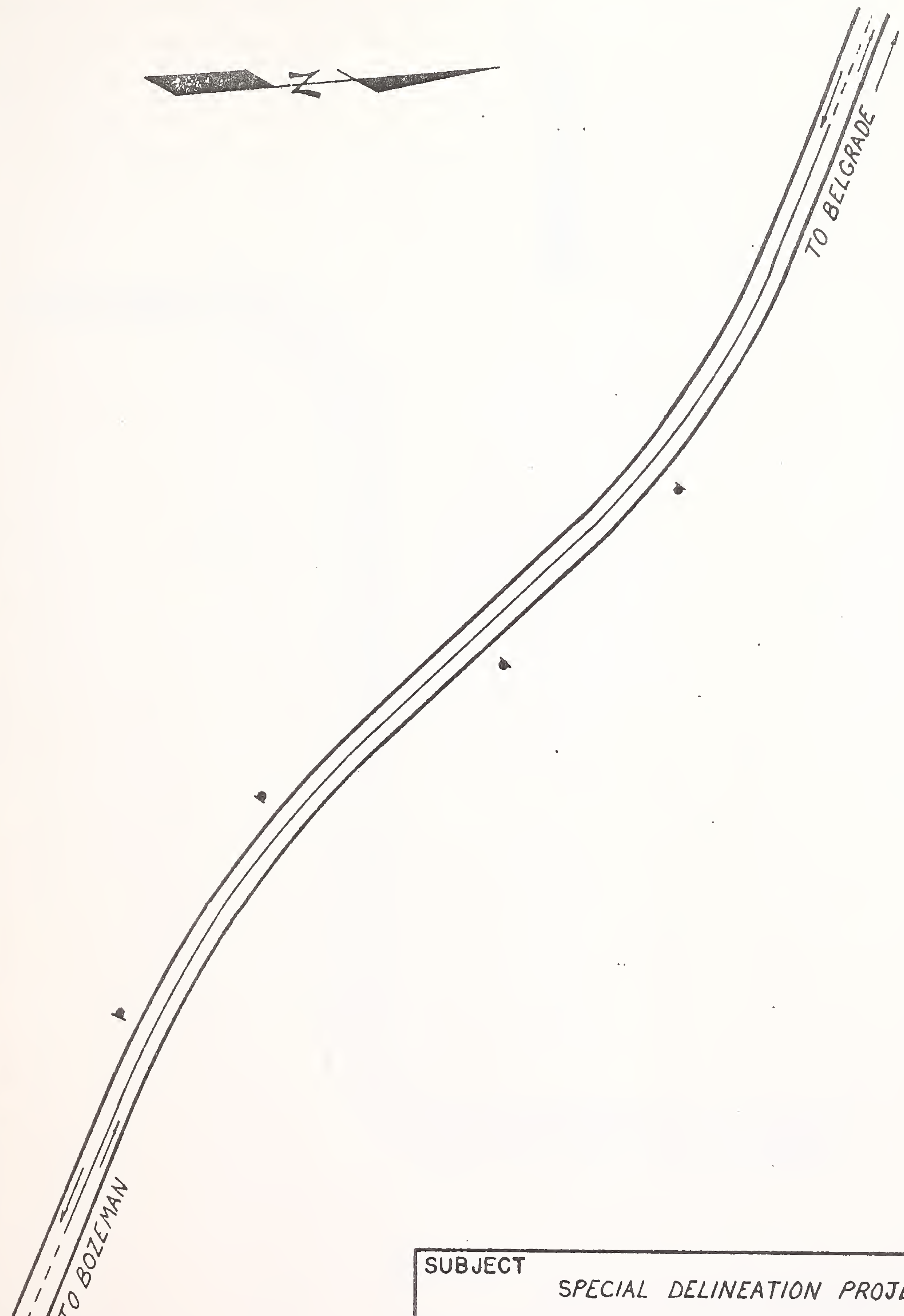
SUBJECT SPECIAL DELINEATION PROJECT	
LOCATION U.S. 2 (FAP1) COLUMBIA HEIGHTS	
MILE MARKER FROM : 141.9 TO : 142.3	SIGN TYPE IV



SUBJECT SPECIAL DELINEATION PROJECT	
LOCATION MONTANA 200(FAP6) PLAINS — PARADISE	
MILE MARKER FROM : 77.6 TO : 78.5	SIGN TYPE IV



SUBJECT SPECIAL DELINEATION PROJECT	
LOCATION U.S. 93 (FAP 7) MISSOULA — LOLO	
MILE MARKER FROM : 85.2 TO : 86.7	SIGN TYPE IV



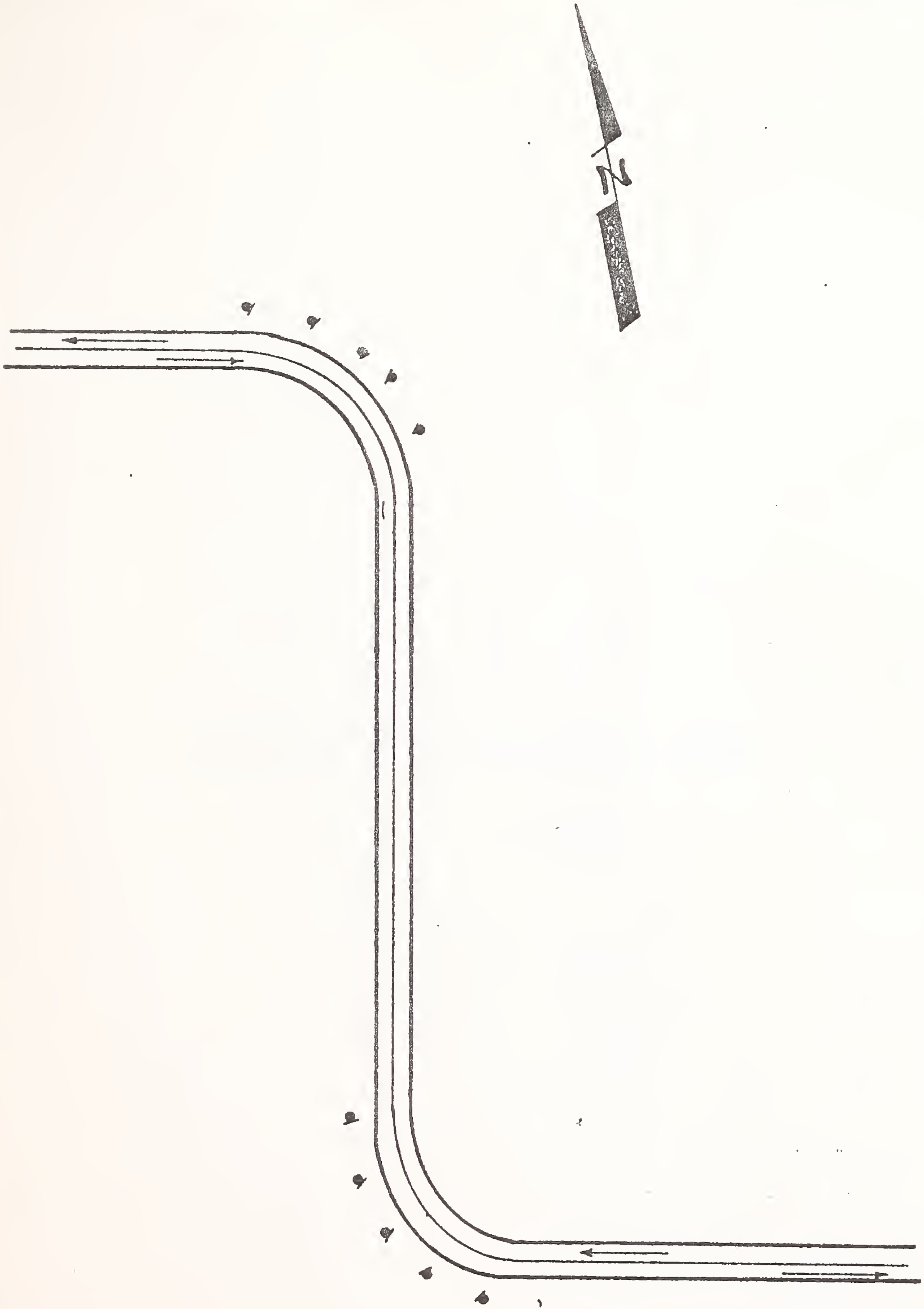
NO SCALE

SUBJECT
SPECIAL DELINEATION PROJECT

LOCATION
U.S. 10 (FAS 205) BOZEMAN — BELGRADE

MILE MARKER
FROM : 22.0
TO : 23.0

SIGN TYPE
IV



NO SCALE

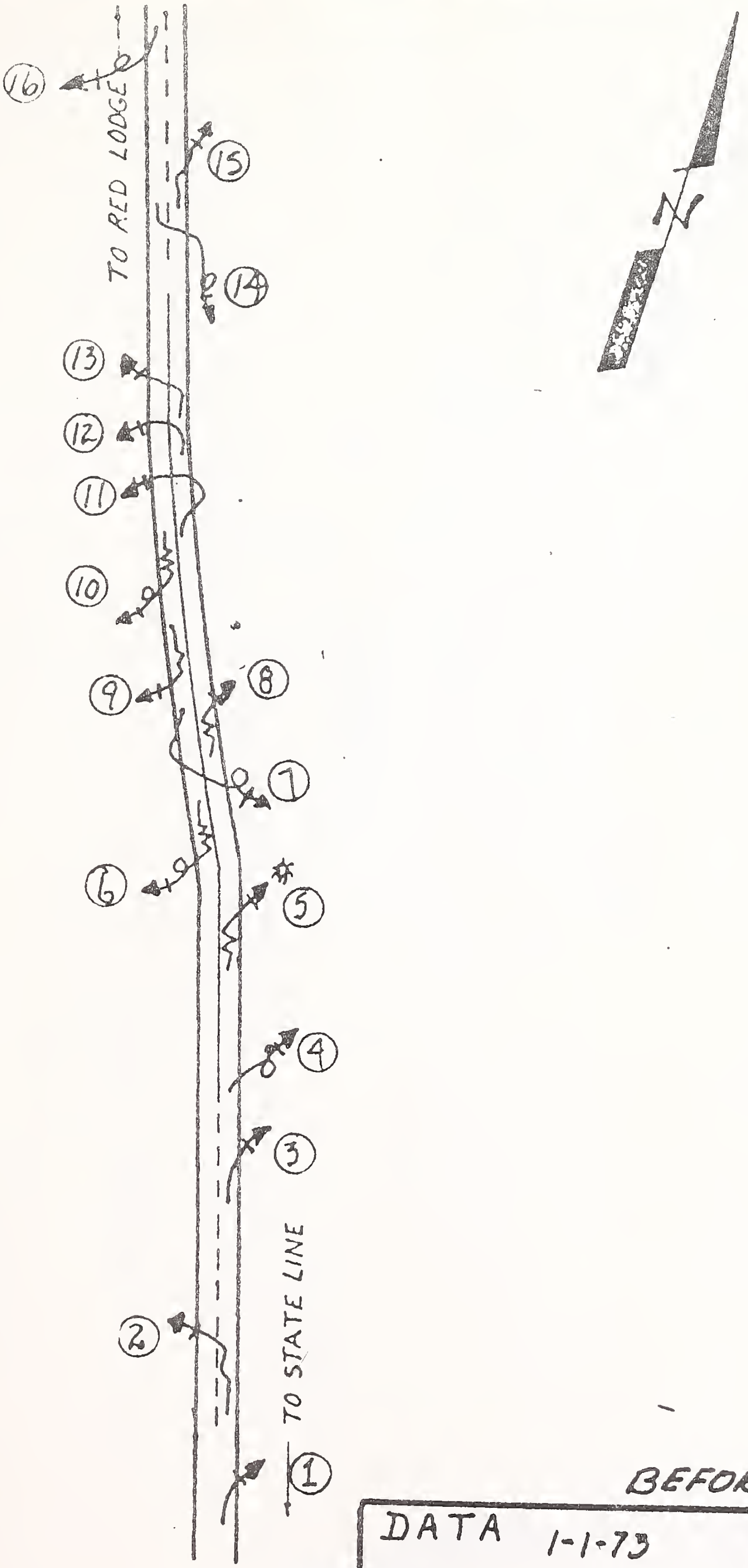
SUBJECT
SPECIAL DELINEATION PROJECT

LOCATION
MONTANA 82 (FAP 82) BIGFORK-SOMERS

MILE MARKER
FROM : 4.7
TO : 5.5

SIGN TYPE
IV

BEFORE AND AFTER COLLISION DIAGRAMS



BEFORE

DATA 1-1-73 6-13-78

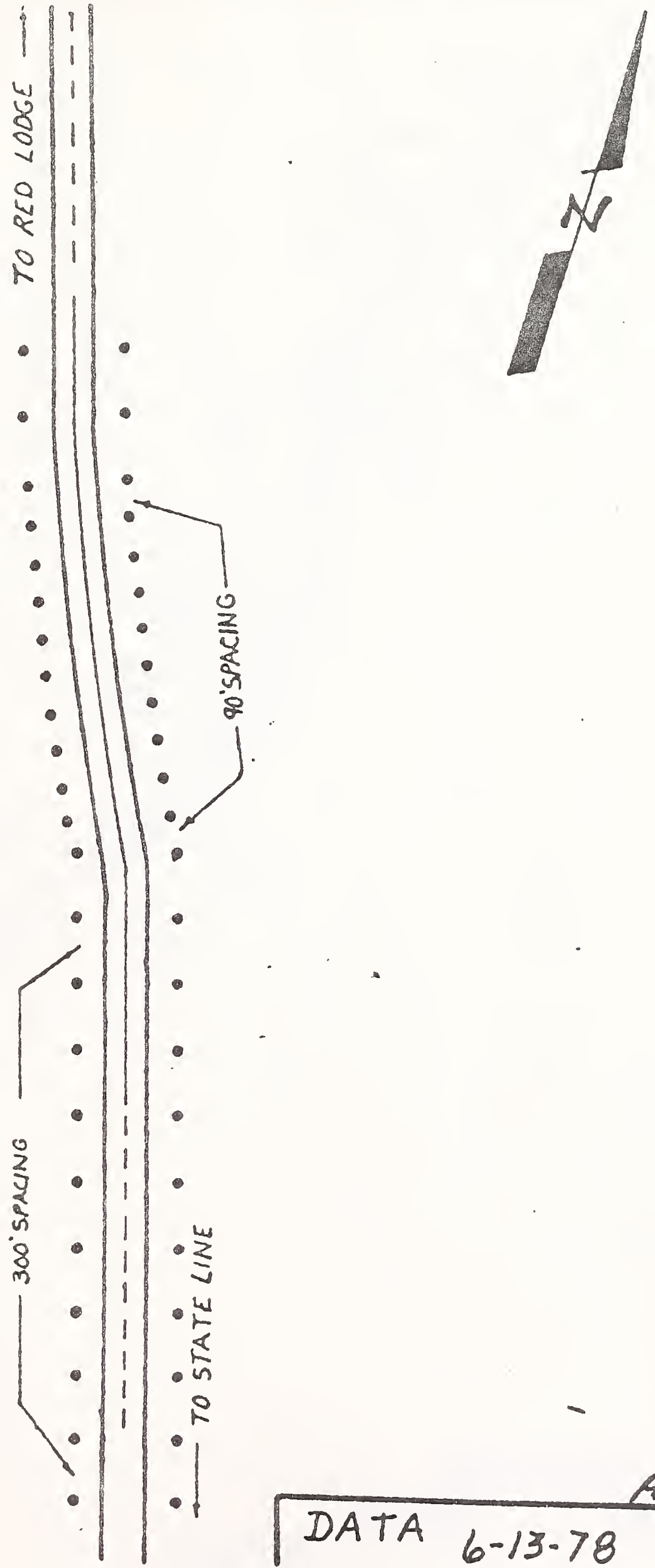
SUBJECT
SPECIAL DELINEATION PROJECT

LOCATION
US. 212 (FAP 28) NEAR RED LODGE

MILE MARKER
FROM : 70.28
TO : 71.0

SIGN TYPE I
silver
with black
dot

NO SCALE



NO SCALE

AFTER

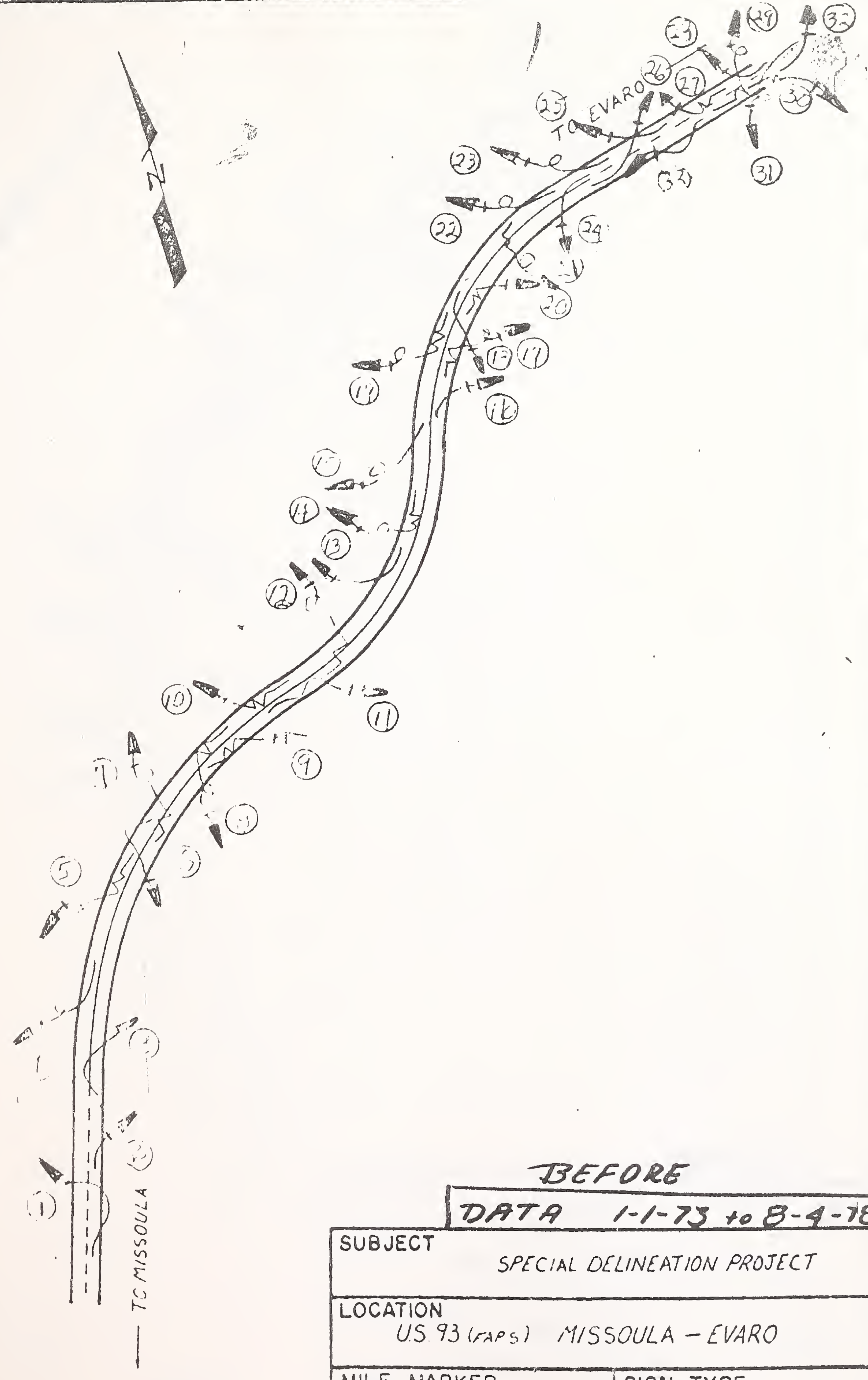
DATA 6-13-78 8-30-80

SUBJECT
SPECIAL DELINEATION PROJECT

LOCATION
US. 212 (FAP 28) NEAR RED LODGE

MILE MARKER
FROM : 70.28
TO : 71.0

SIGN TYPE
I



BEFORE

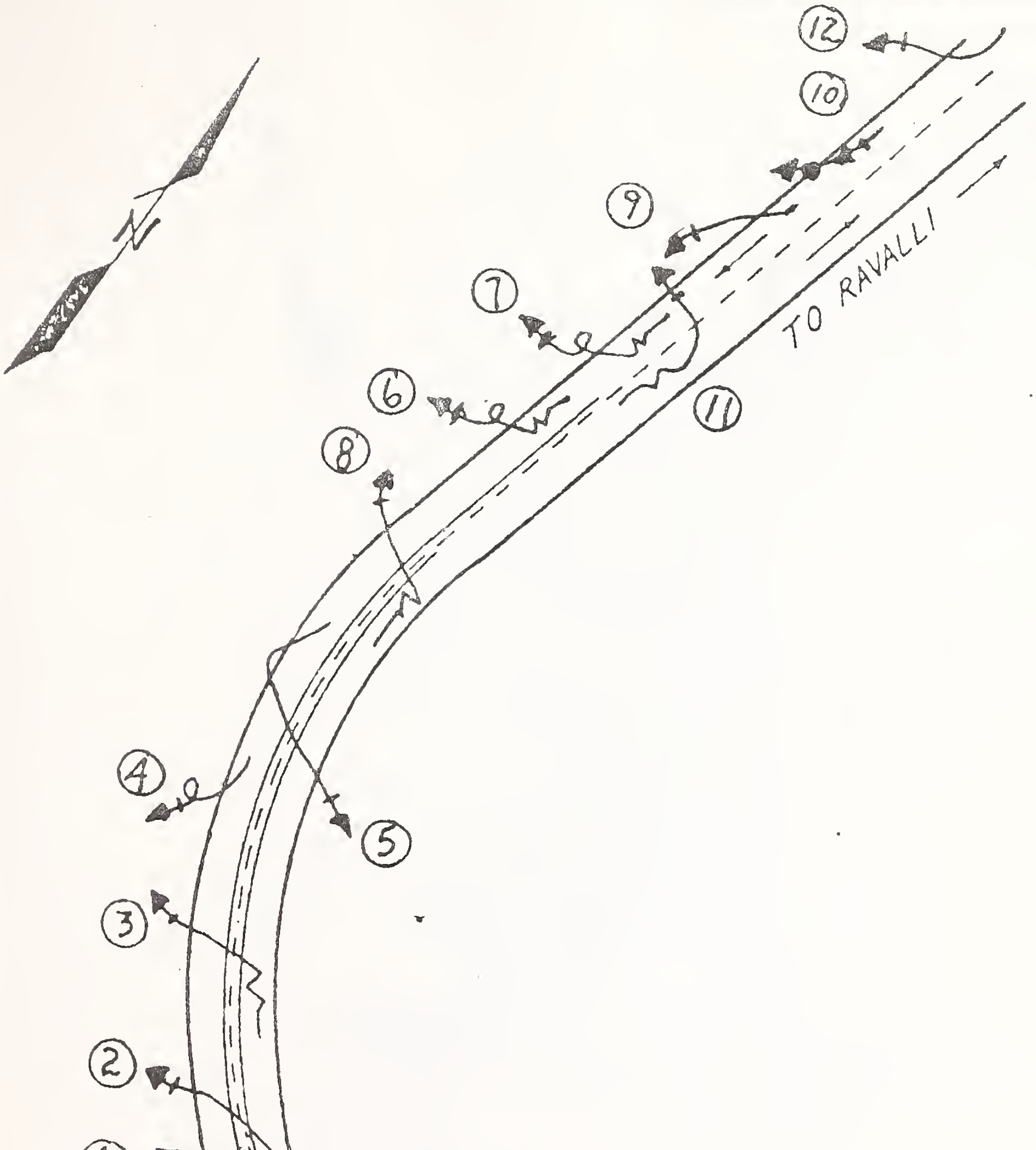
DATA 1-1-73 to 8-4-78

SUBJECT
SPECIAL DELINEATION PROJECT

LOCATION
U.S. 93 (FAP 5) MISSOULA — EVARO

MILE MARKER
FROM : 2.78
TO : 4.00

SIGN TYPE
I



NO SCALE

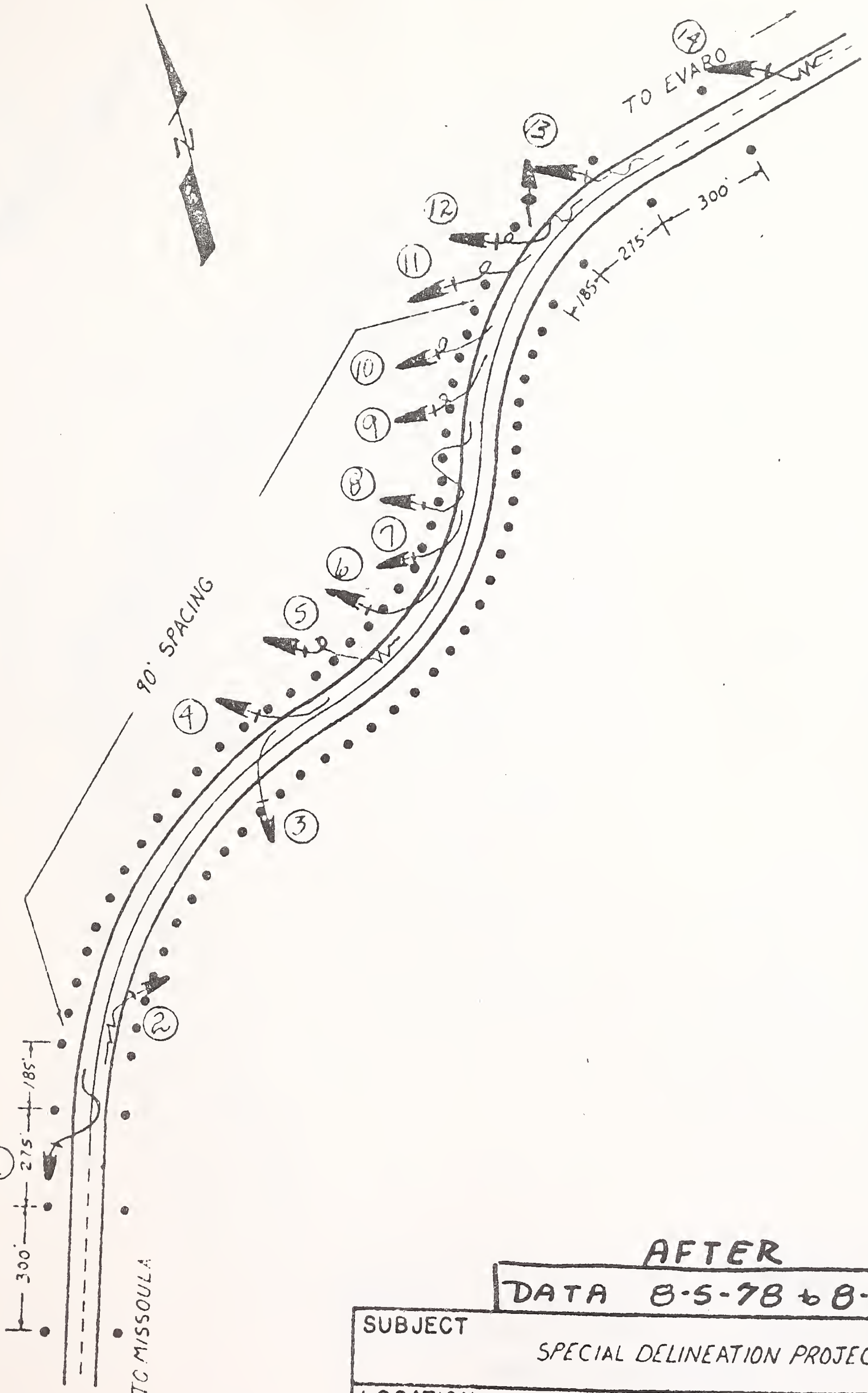
BEFORE

DATA	1-1-73	7-27-78

SUBJECT
SPECIAL DELINEATION PROJECT

LOCATION
US. 93 (FAP 5) MISSOULA — RAVALLI

MILE MARKER	SIGN TYPE
FROM : 24.7 TO : 25.7	yellow & black W1-1 II



NO SCALE

AFTER

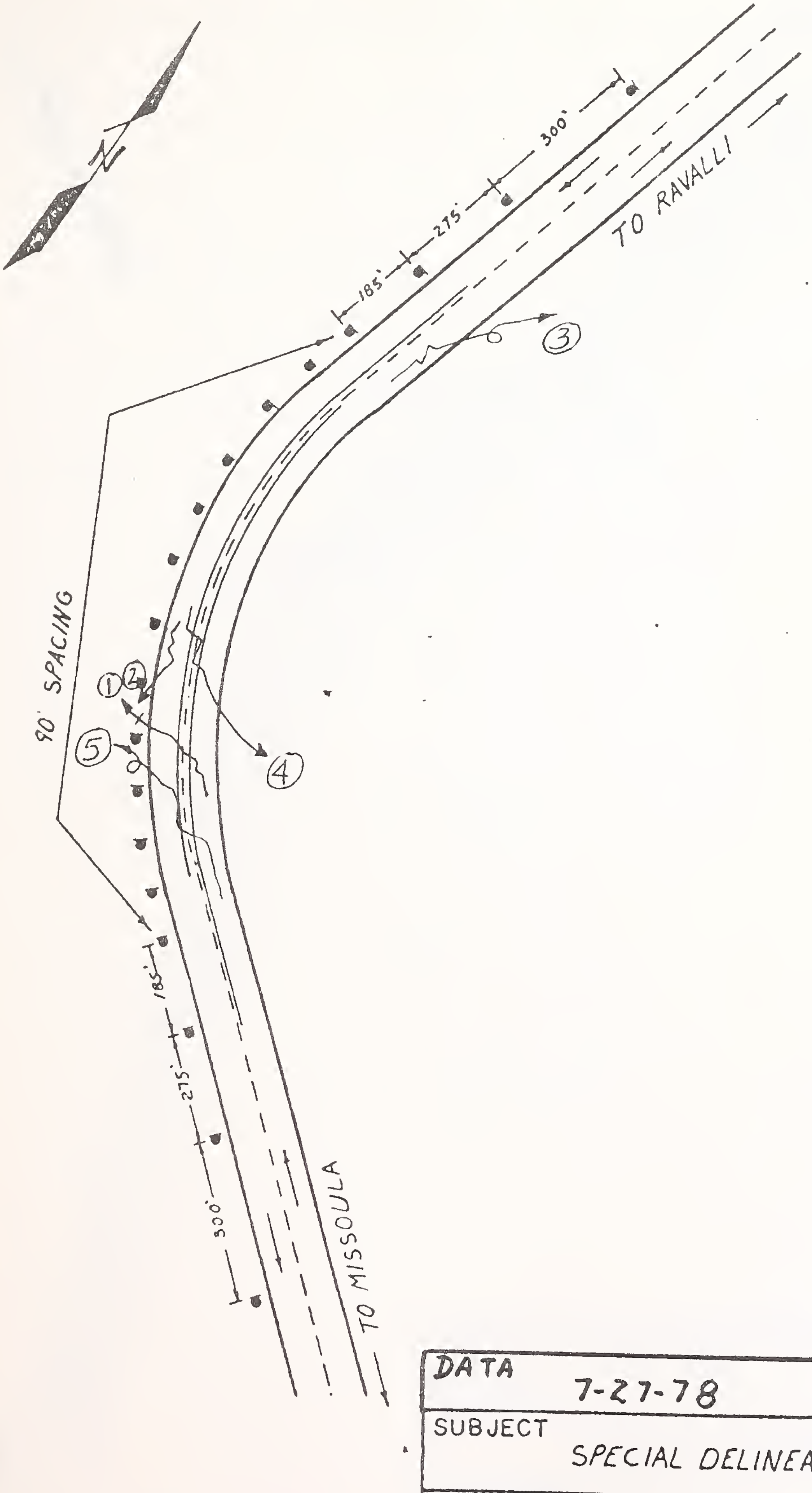
DATA 8-5-78 to 8-30-80

SUBJECT
SPECIAL DELINEATION PROJECT

LOCATION
U.S. 93 (FAP 5) MISSOULA – EVARO

MILE MARKER
FROM 2.78
TO 4.00

SIGN TYPE
I



AFTER

DATA
7-27-78
8-30-80

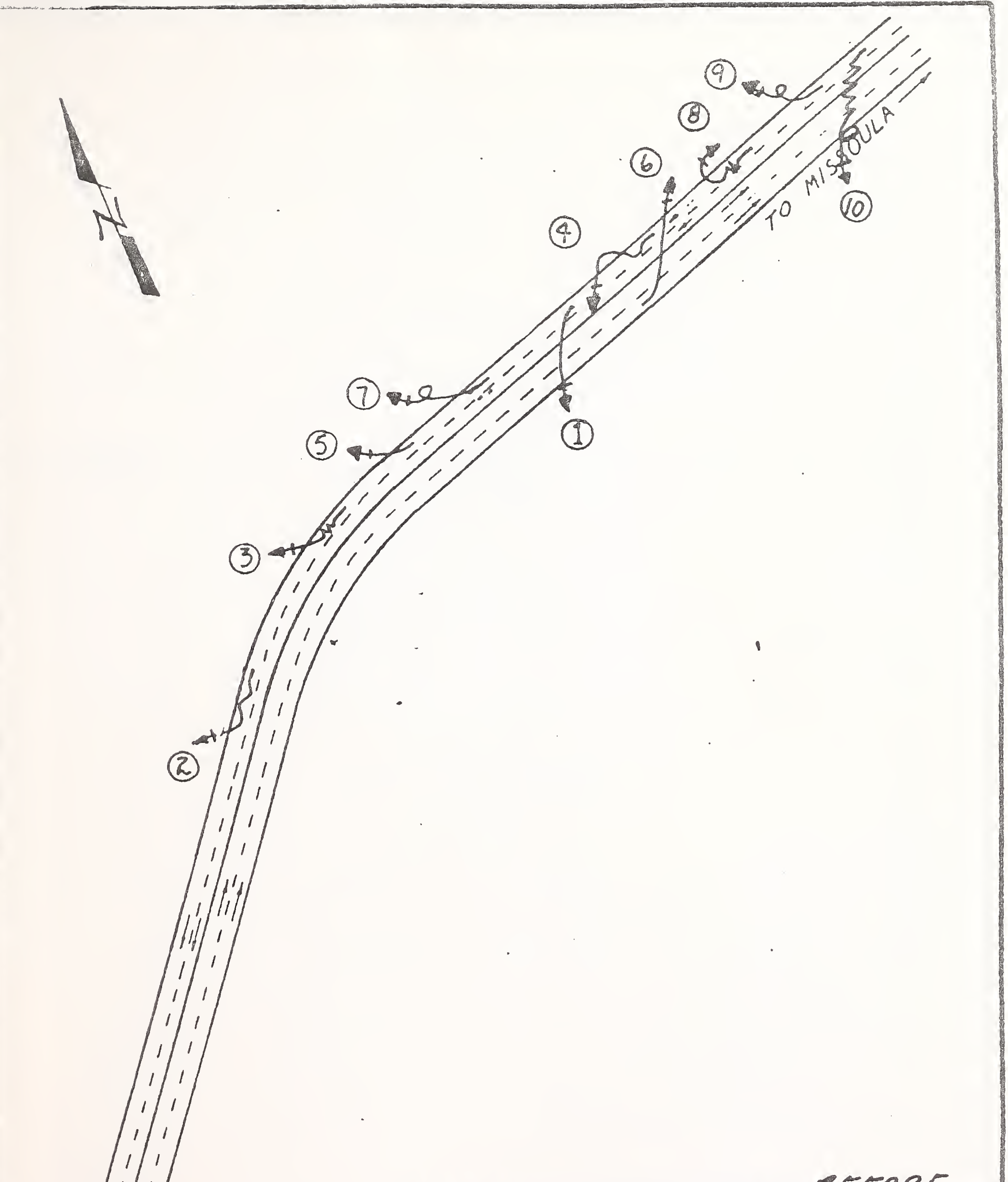
SUBJECT
SPECIAL DELINEATION PROJECT

LOCATION
US 93 (FAP 5) MISSOULA — RAVALLI

MILE MARKER
FROM : 24.7
TO : 25.7

SIGN TYPE
II

NO SCALE



BEFORE

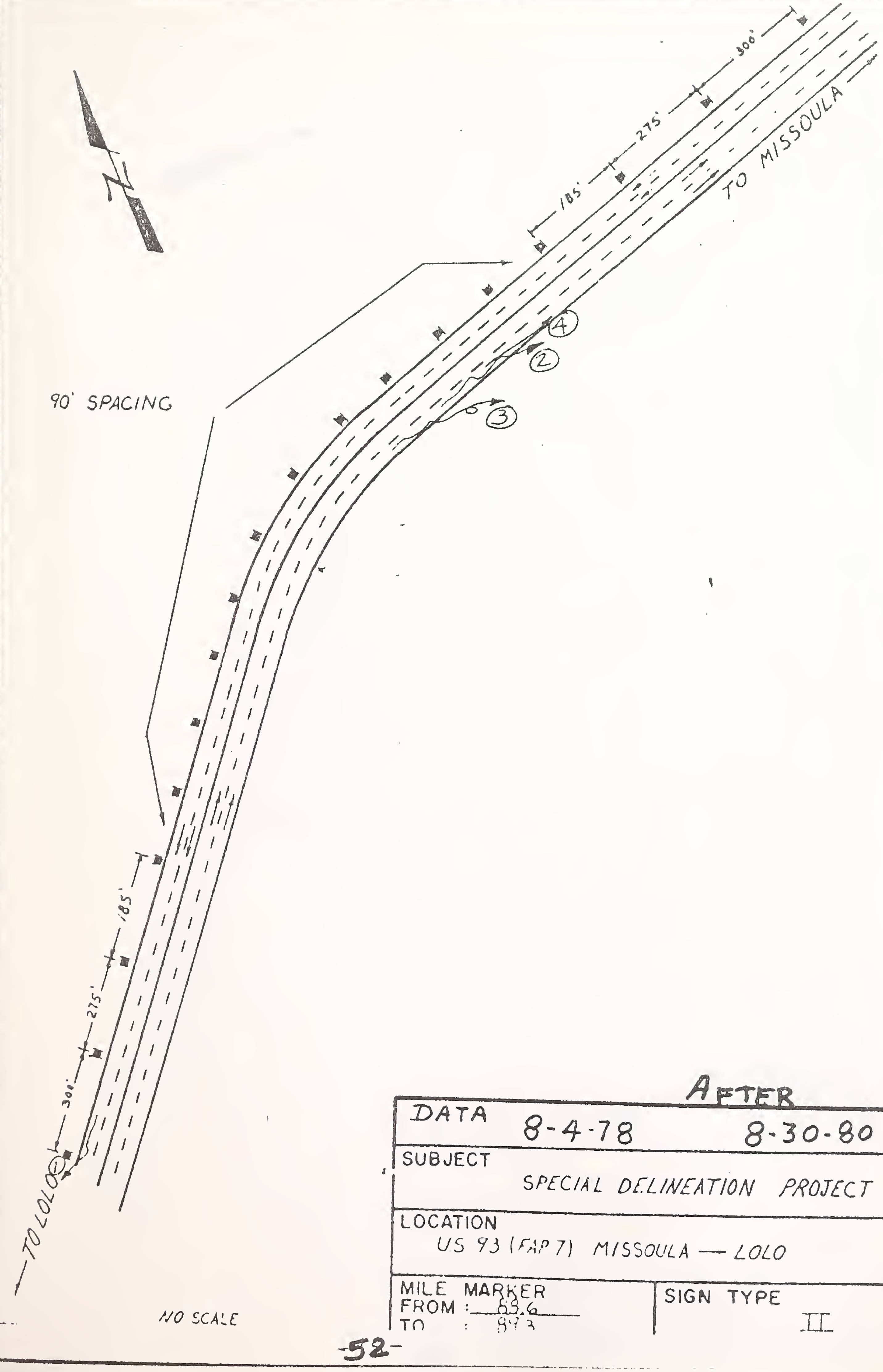
DATA 1-1-73 8-14-78

SUBJECT
SPECIAL DELINEATION PROJECT

LOCATION
U.S. 93 (FAP 7) MISSOULA — LOLO

MILE MARKER
FROM : 88.6
TO : 89.3

SIGN TYPE
yellow & black II
71-1



AFTER

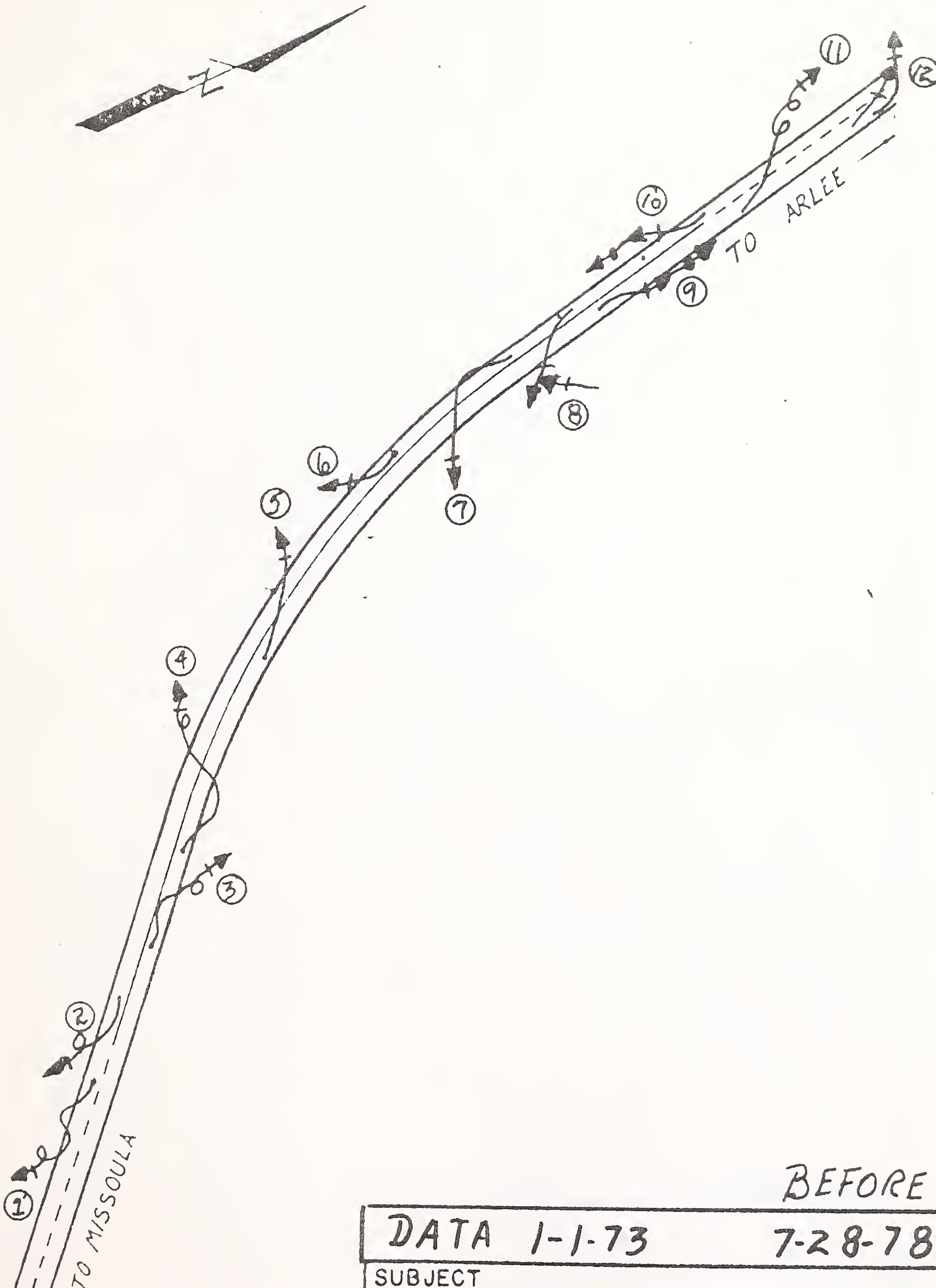
DATA 8-4-78 8-30-80

SUBJECT
SPECIAL DELINEATION PROJECT

LOCATION
US 93 (FAP 7) MISSOULA — LOLO

MILE MARKER
FROM : 83.6
TO : 83.3

SIGN TYPE
II



NO SCALE

BEFORE

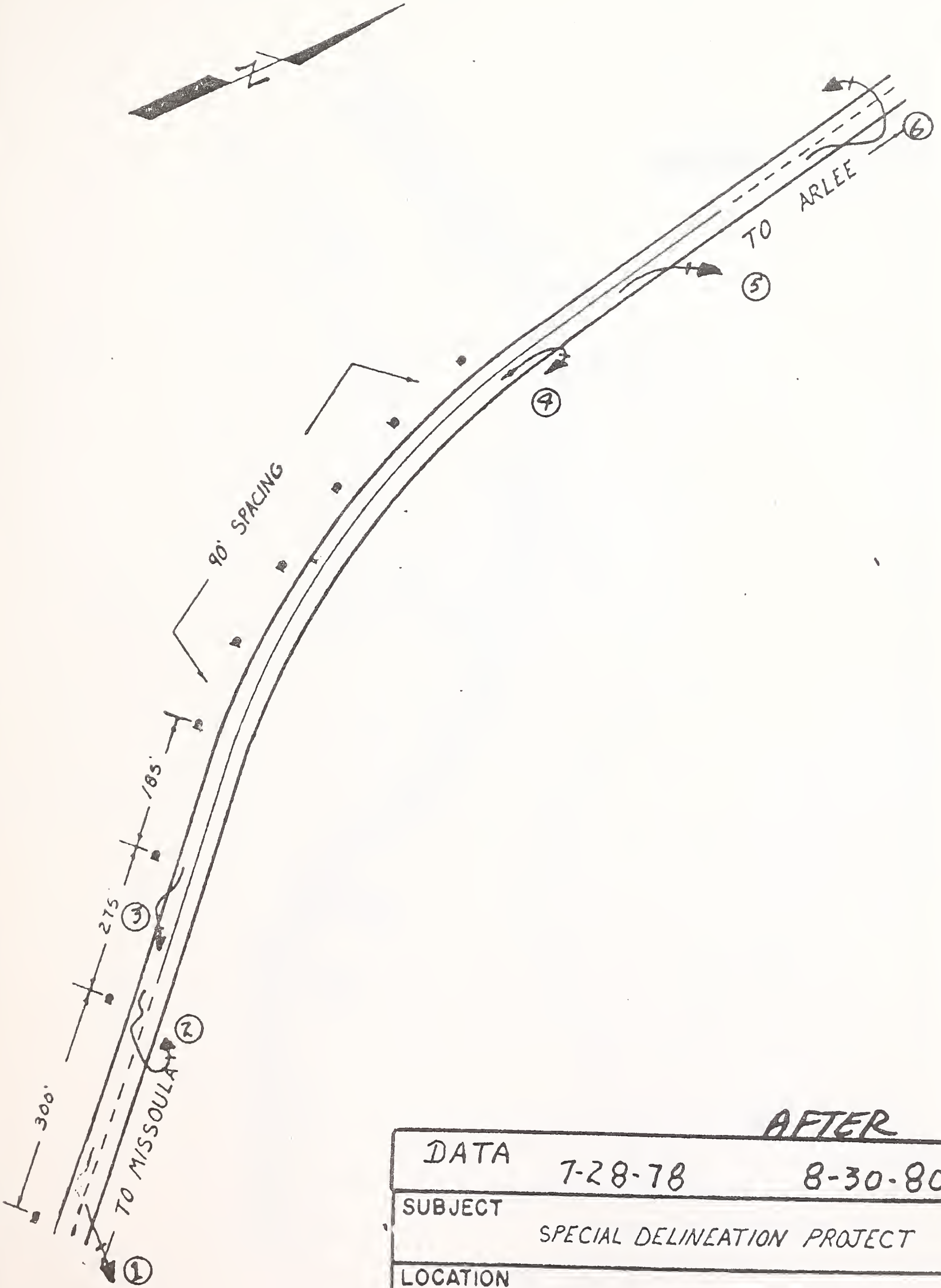
DATA 1-1-73 7-28-78

SUBJECT
SPECIAL DELINEATION PROJECT

LOCATION
US.93 (FAPS) ARLEE —— MISSOULA

MILE MARKER
FROM : [illegible]
TO : 17.6

SIGN TYPE
Yellow & Black W-1 II



NO SCALE

AFTER

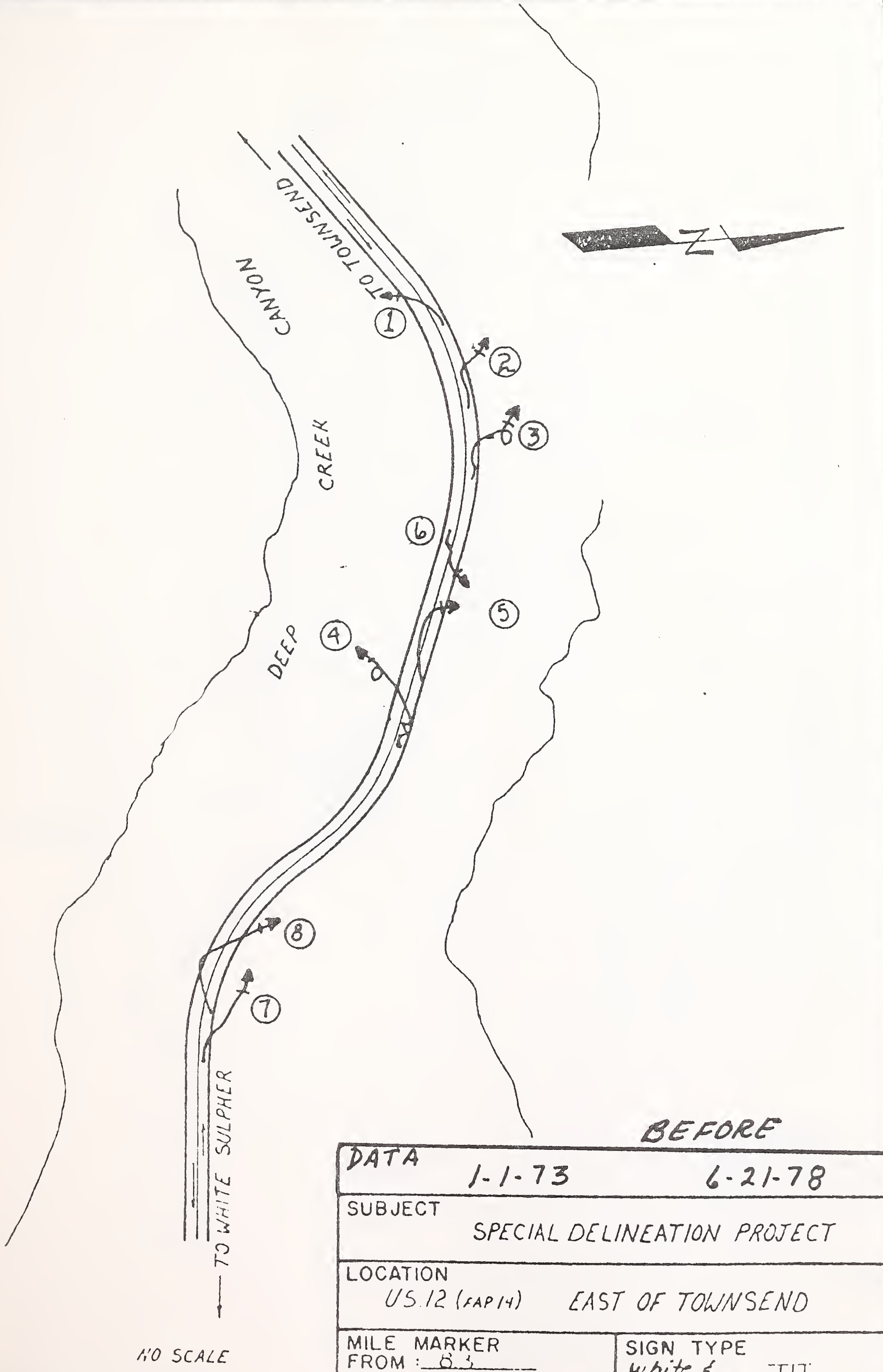
DATA 7-28-78 8-30-80

SUBJECT
SPECIAL DELINEATION PROJECT

LOCATION
US. 93 (FAPS) ARLEE —— MISSOULA

MILE MARKER
FROM 171
TO 176

SIGN TYPE
II



BEFORE

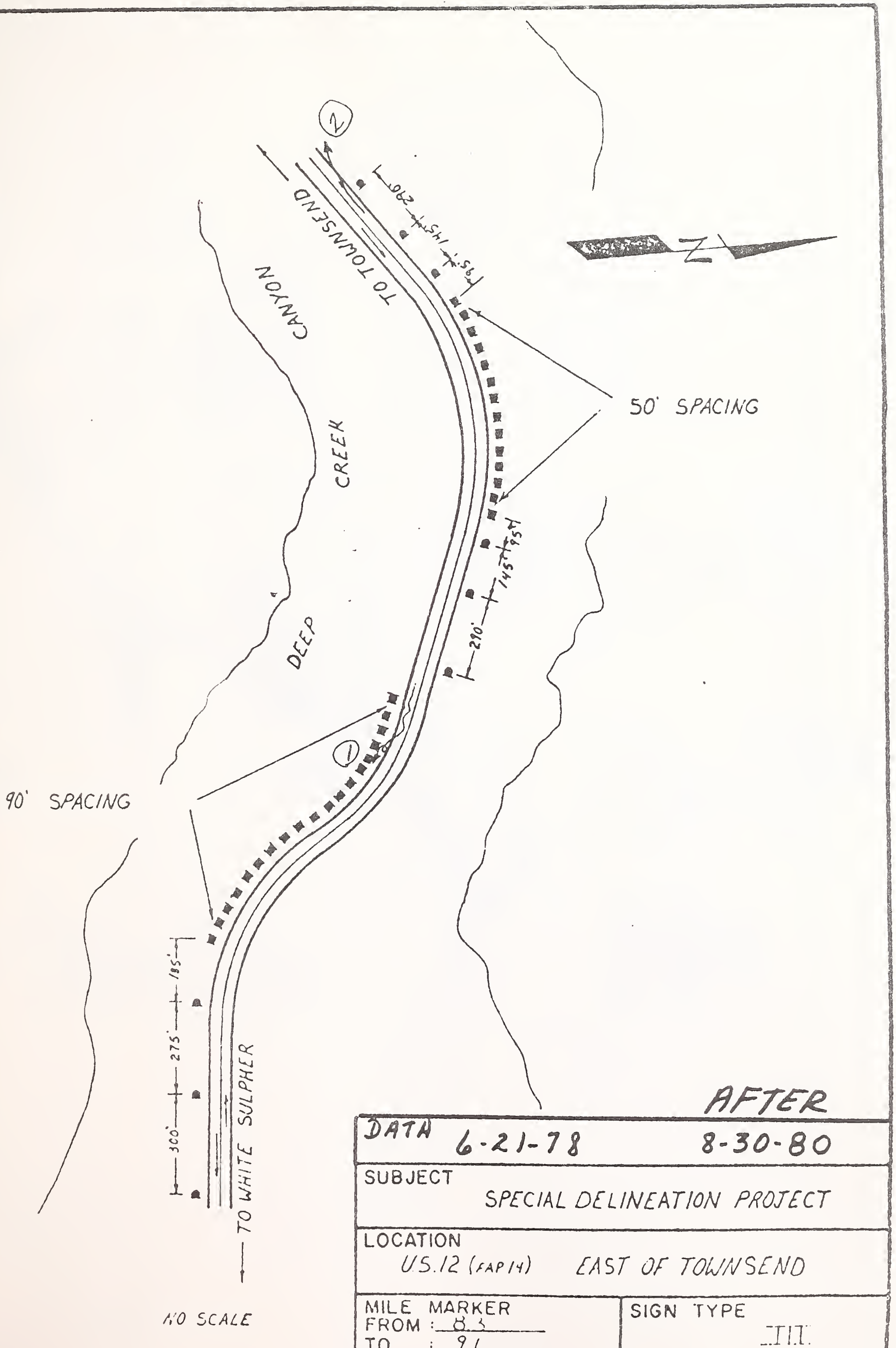
DATA 1-1-73 6-21-78

SUBJECT
SPECIAL DELINEATION PROJECT

LOCATION
US.12 (FAP 14) EAST OF TOWNSEND

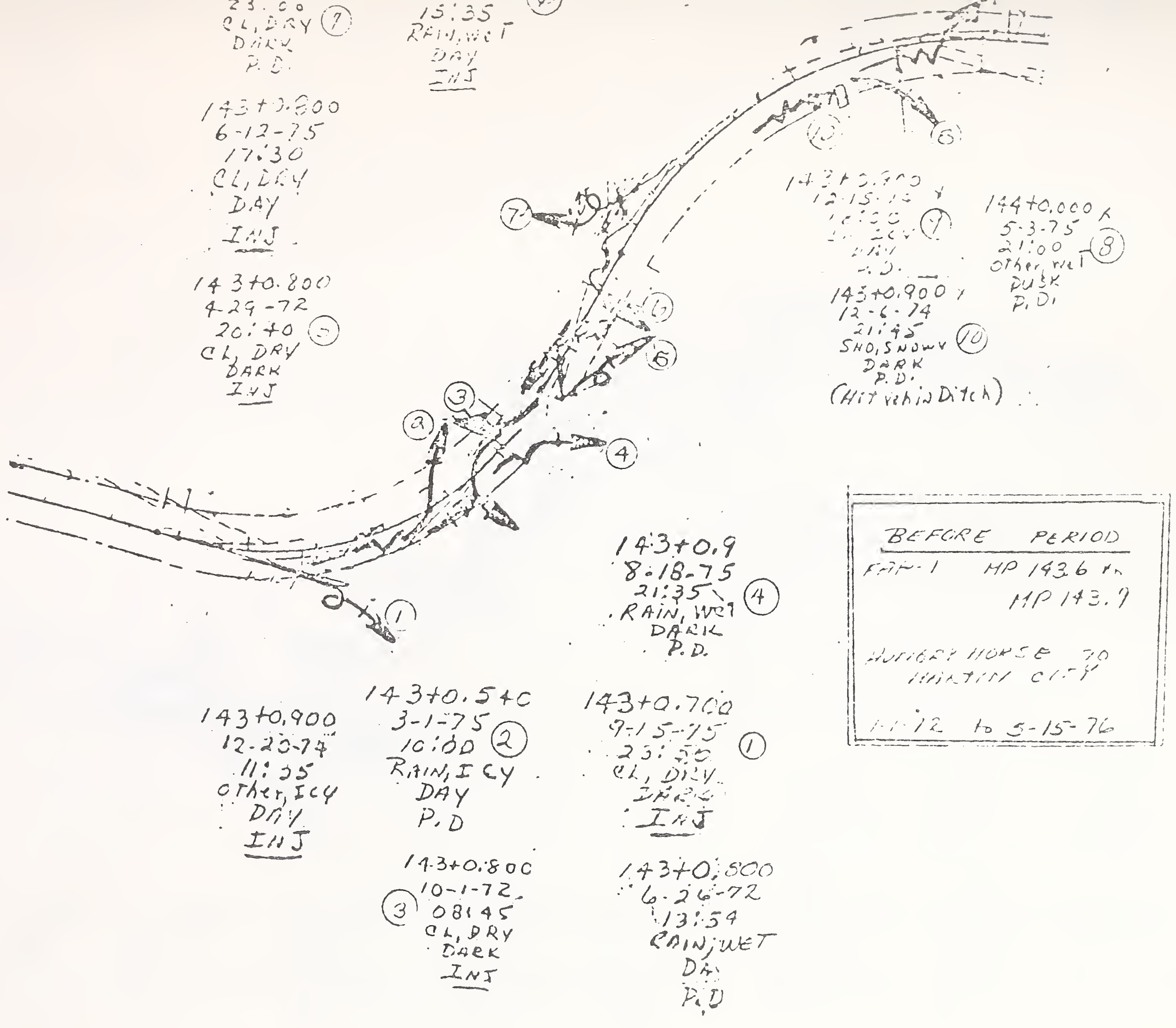
MILE MARKER
FROM : 83
TO : 91

SIGN TYPE
white & black W1-1 III



AFTER

DATA 6-21-78	8-30-80
SUBJECT SPECIAL DELINEATION PROJECT	
LOCATION U.S.12 (FAP 14) EAST OF TOWNSEND	
MILE MARKER FROM : 83 TO : 91	SIGN TYPE III

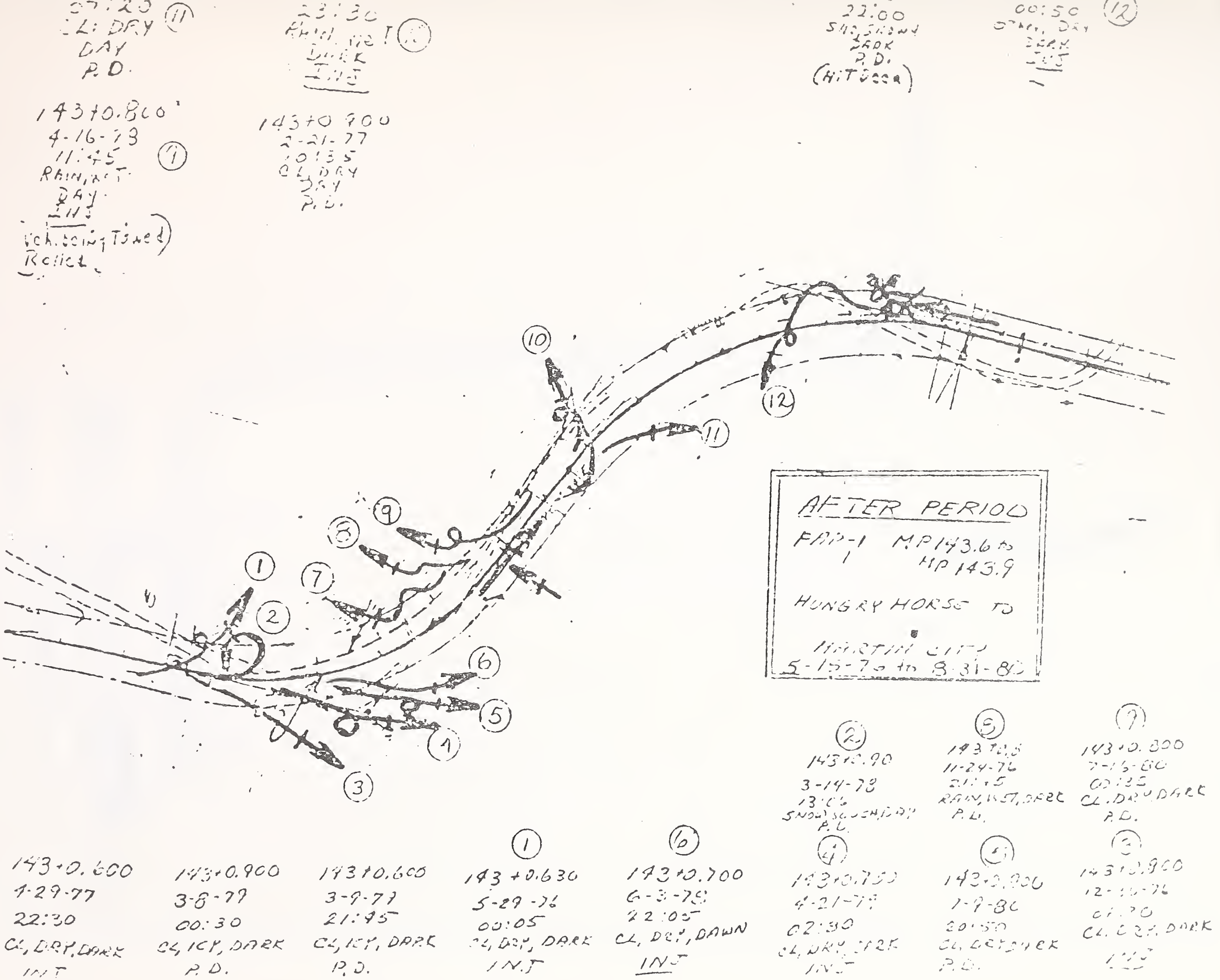


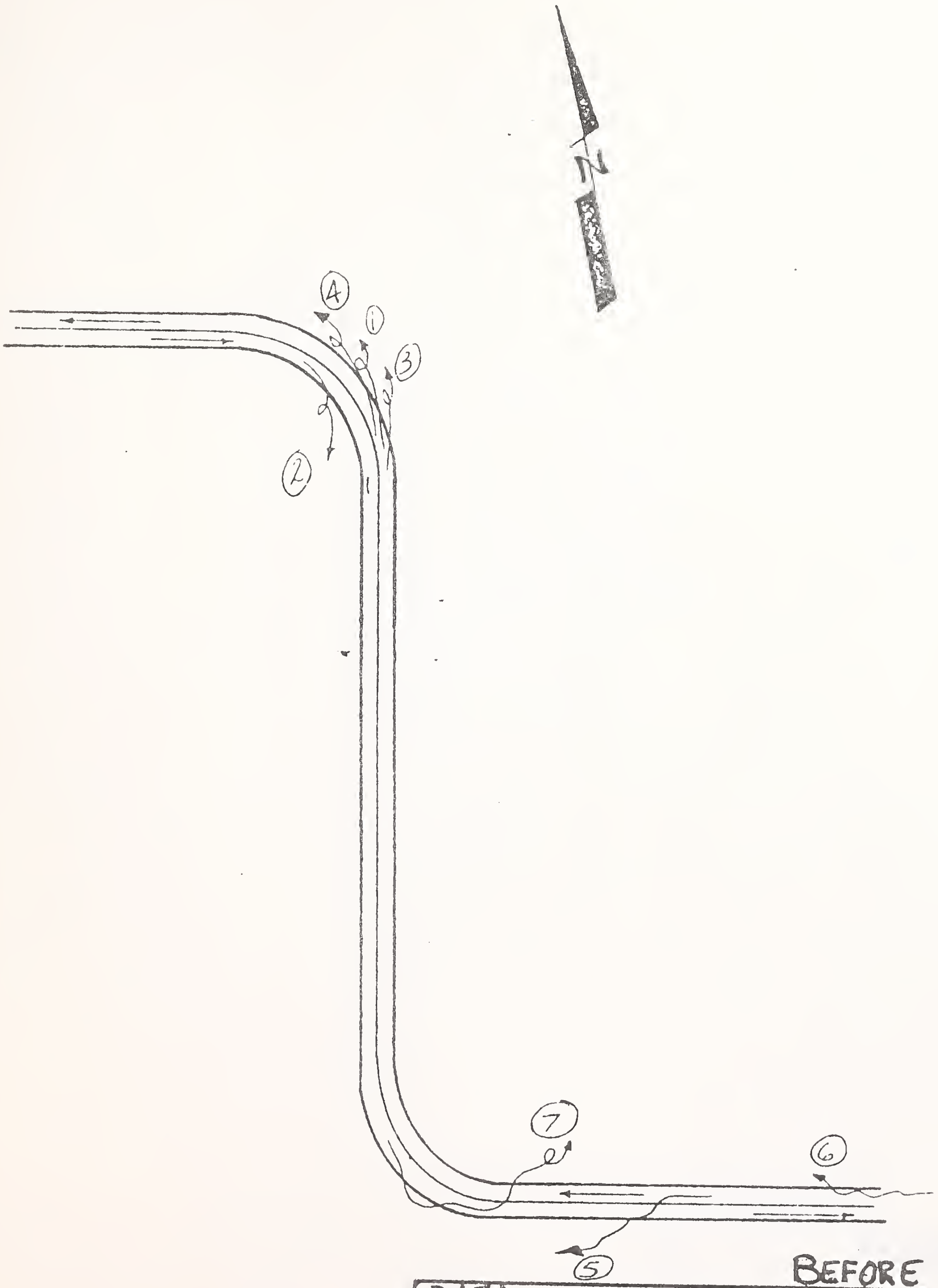
BEFORE PERIOD

FAP-1 MP 143.6 to
MP 143.9

HUNGRY HORSE TO
MARTIN CITY

1-1-72 to 5-15-76

AFTER PERIOD
FAP-1 MP 143.6 to MP 143.9
HUNGRY HORSE TO MARTIN CITY
5-15-7? to 8-31-80
(11) 07:20 CL; DRY DAY P.D.
(?) 23:30 RAIN, WET DARK INJ
(7) 143+0.800' 4-16-73 11:45 RAIN, WET DAY INJ (Vehicle going Towed Rolled)
143+0 900 2-21-77 10:35 CL, DRY DAY P.D.
22:00 SNOW, SNOWY DARK P.D. (HIT DEER)
(12) 00:50 CLEAR, DRY DARK INJ
143+0.600 1-29-77 22:30 CL, DRY, DARK INT
143+0.900 3-8-79 00:30 CL, ICY, DARK P.D.
143+0.600 3-9-79 21:45 CL, ICY, DARK P.D.
(1) 143+0.630 5-29-76 00:05 CL, DRY, DARK INJ
(6) 143+0.700 6-3-79 22:05 CL, DRY, DAWN INJ
(2) 143+0.90 3-14-78 13:06 SNOW, SLUSH, DAY P.D.
(4) 143+0.750 4-21-79 02:30 CL, DRY, DARK INJ
(5) 143+0.8 11-24-76 21:45 RAIN, WET, DARK P.D.
(?) 143+0.800 1-9-80 20:50 CL, DRY, DARK P.D.
(9) 143+0.800 7-16-80 00:35 CL. DRY, DARK P.D.
(3) 143+0.900 12-??-76 01:?0 CL. DRY, DARK INJ
1
2
3
4
5
6
7
8
9
10
11
12



BEFORE

DATA 1-1-73 5-26-78

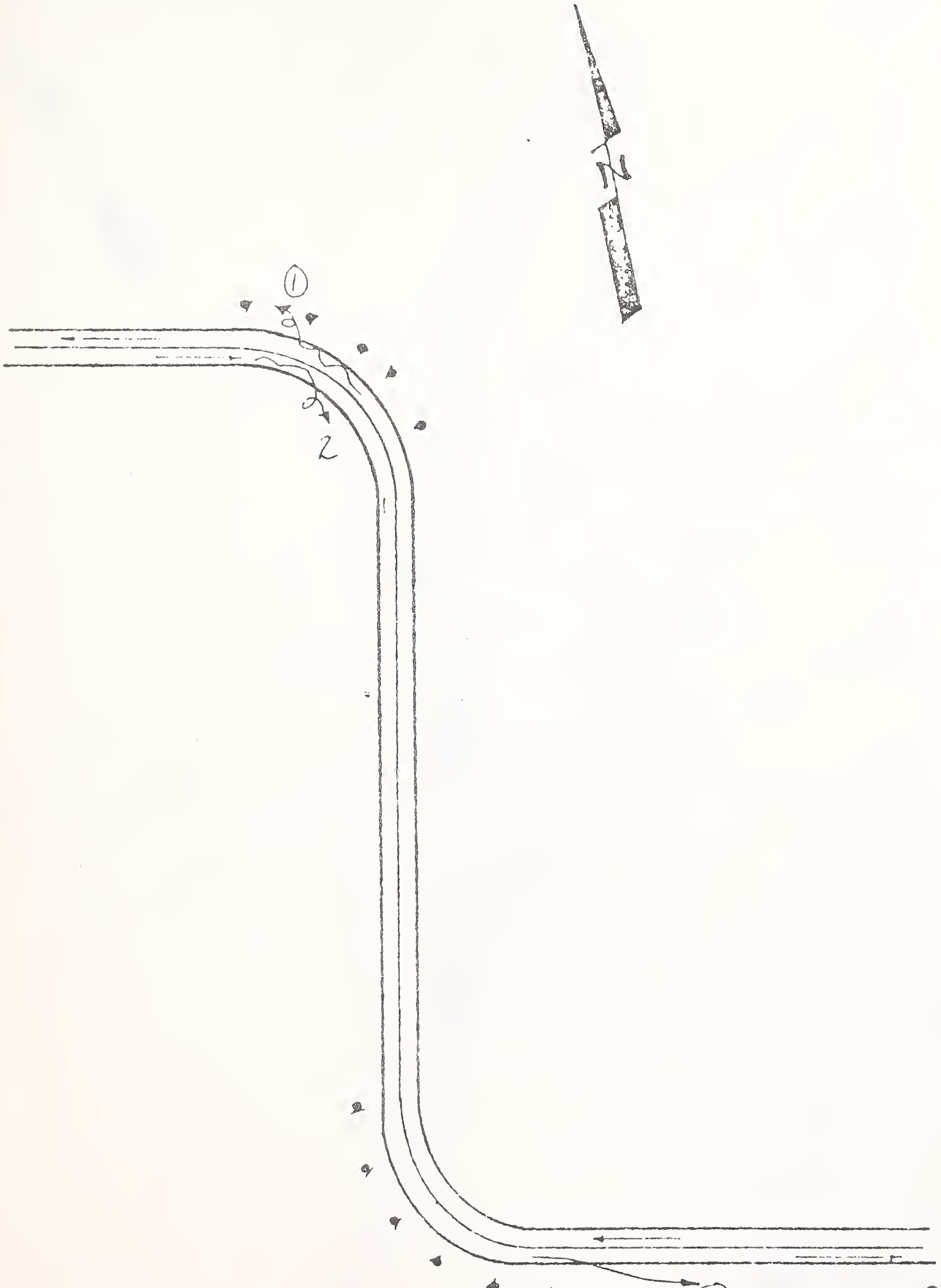
SUBJECT
SPECIAL DELINEATION PROJECT

LOCATION
MONTANA 82 (FAP 82) BIGFORK-SOMERS

NO SCALE

MILE MARKER
FROM : 17
TO : 5.5

SIGN TYPE
IV



NO SCALE

AFTER

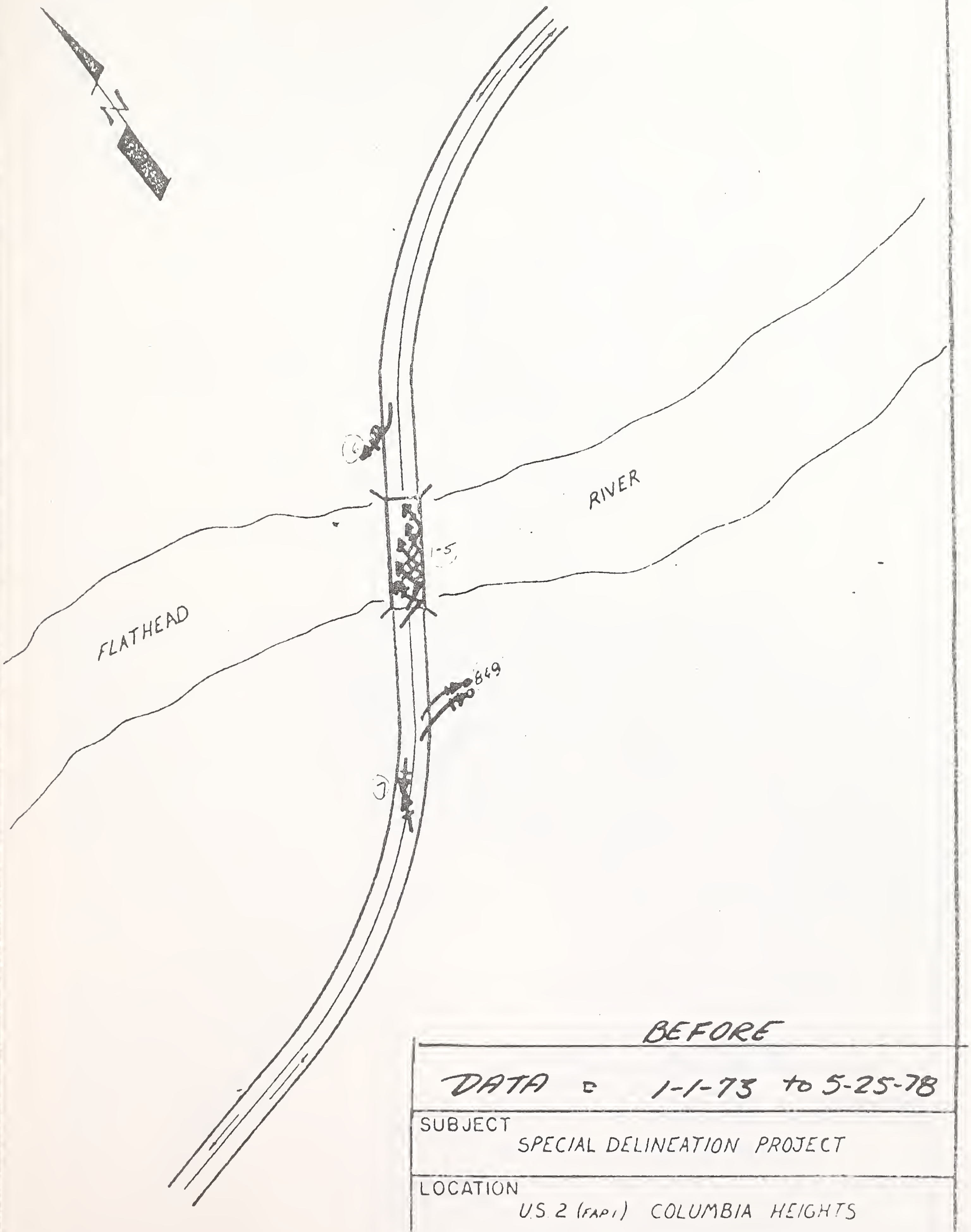
DATA 5-26-78 8-30-80

SUBJECT
SPECIAL DELINEATION PROJECT

LOCATION
MONTANA 82 (US 92) BIGFORK - SOMERS

MILE MARKER
FROM 2.2
TO 5.5

SIGN TYPE
IV



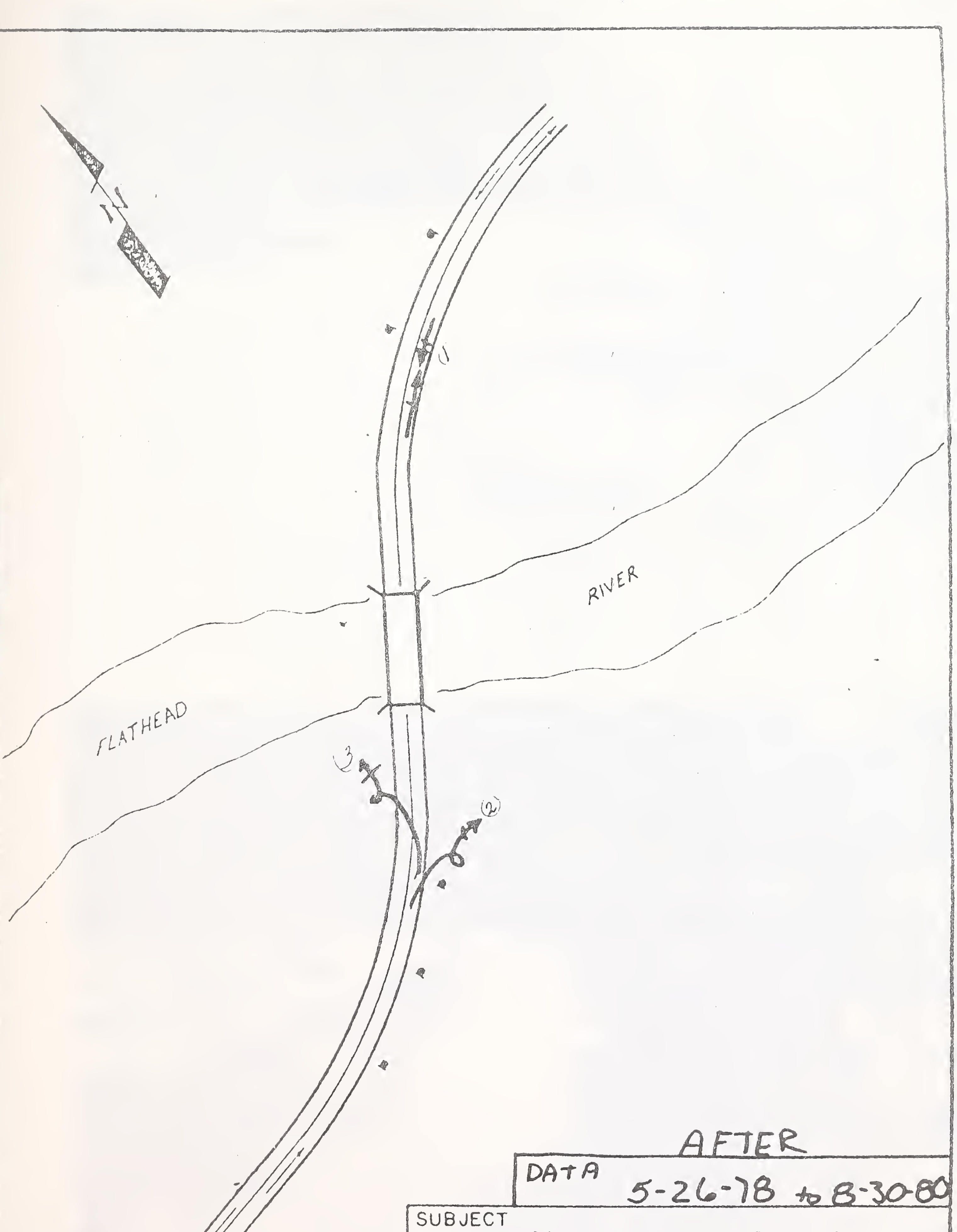
BEFORE

DATA = 1-1-73 to 5-25-78

SUBJECT
SPECIAL DELINEATION PROJECT

LOCATION
US 2 (FAP 1) COLUMBIA HEIGHTS

MILE MARKER FROM : 141.9 TO : 142.3	SIGN TYPE IV



AFTER

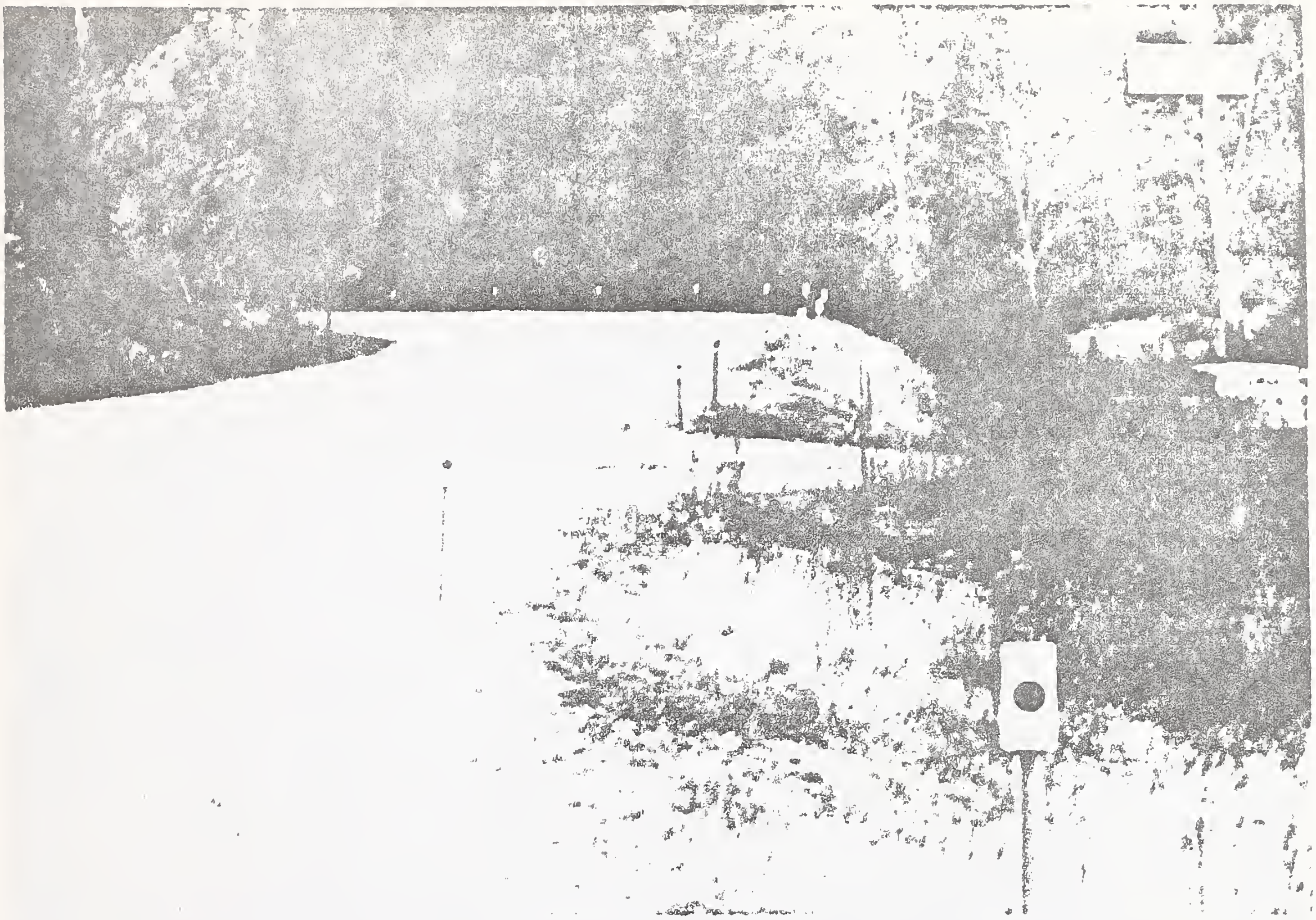
DATA 5-26-78 to 8-30-80

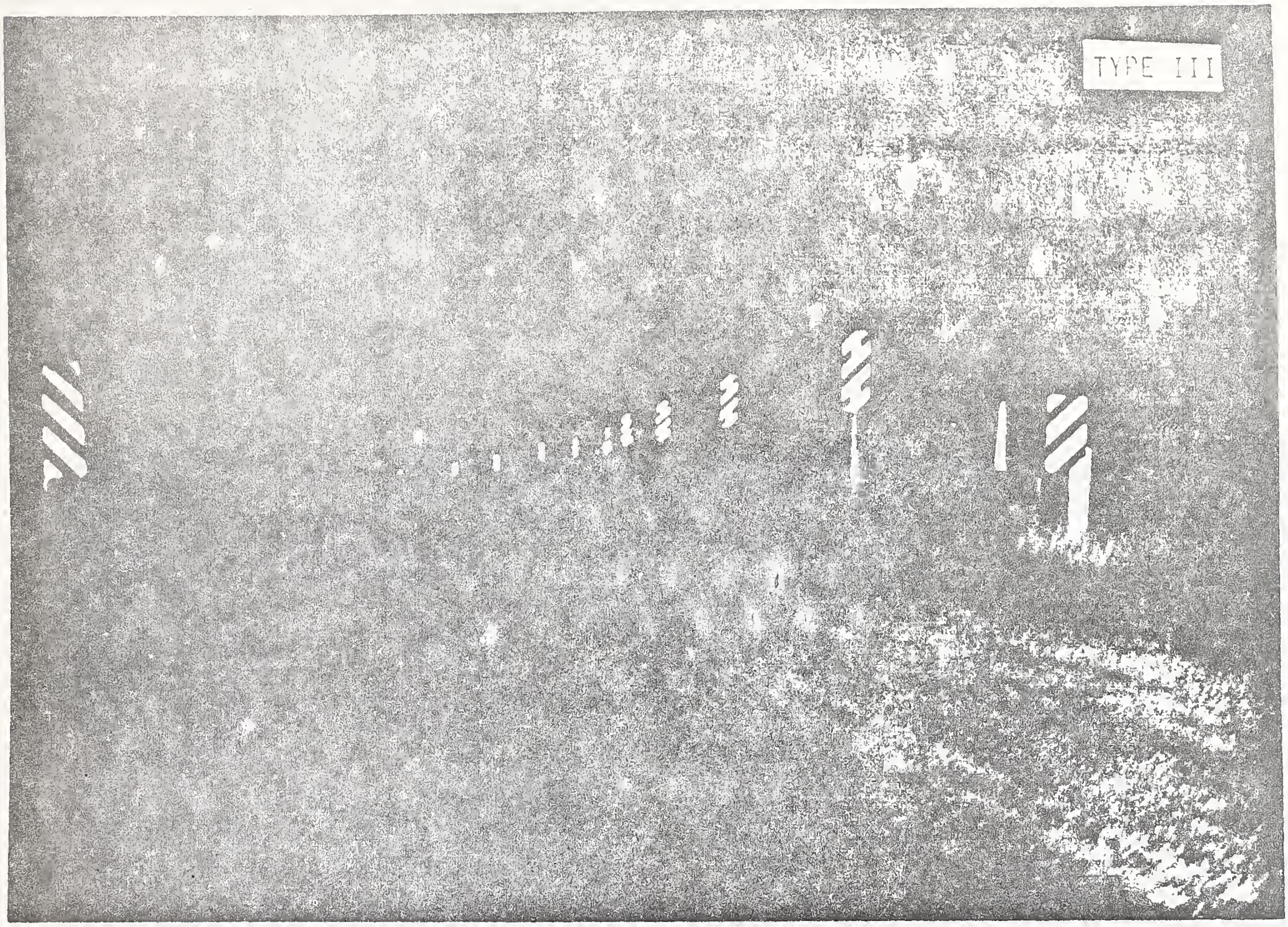
SUBJECT
SPECIAL DELINEATION PROJECT

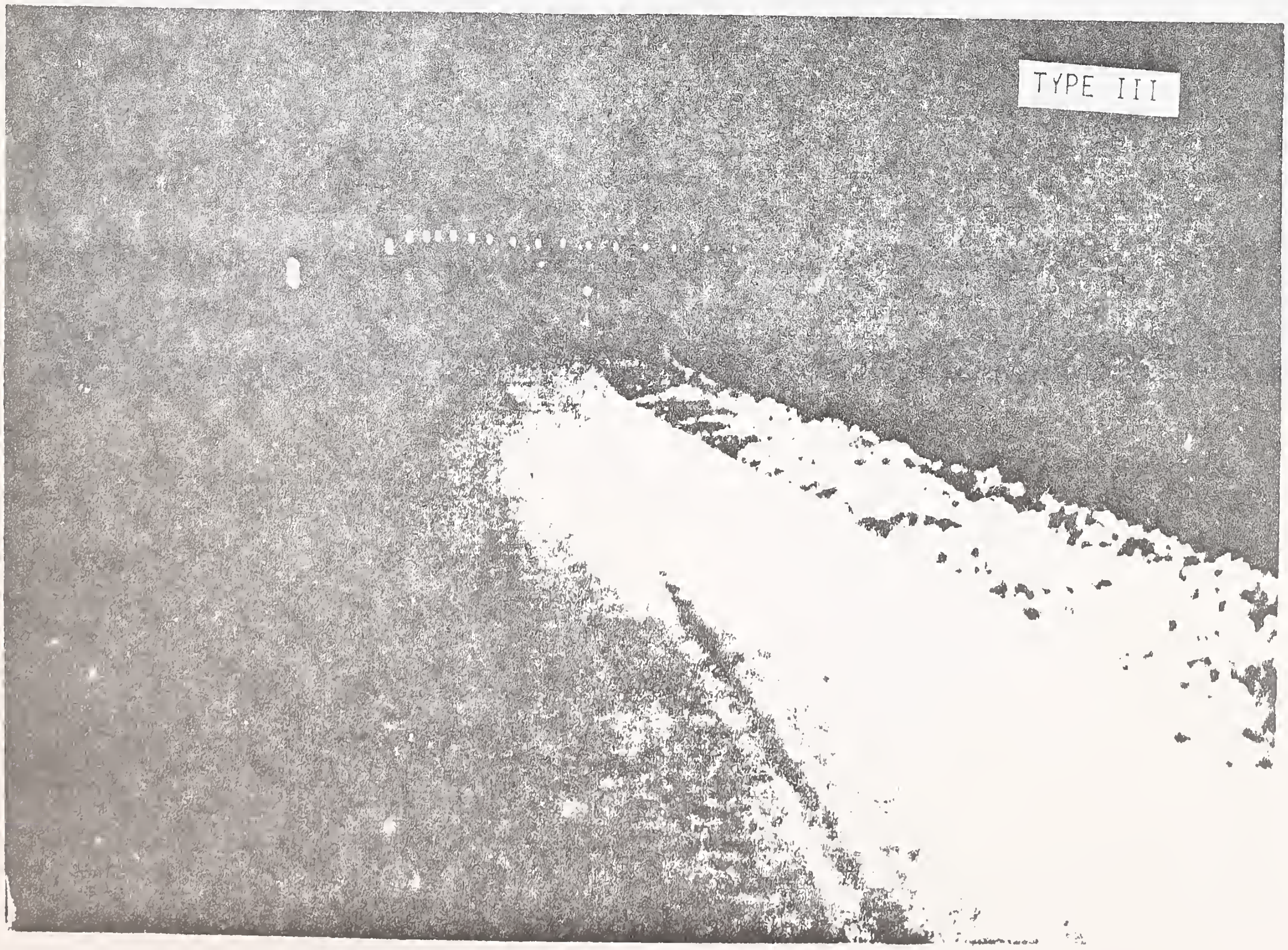
LOCATION
U.S. 2 (FAP 1) COLUMBIA HEIGHTS

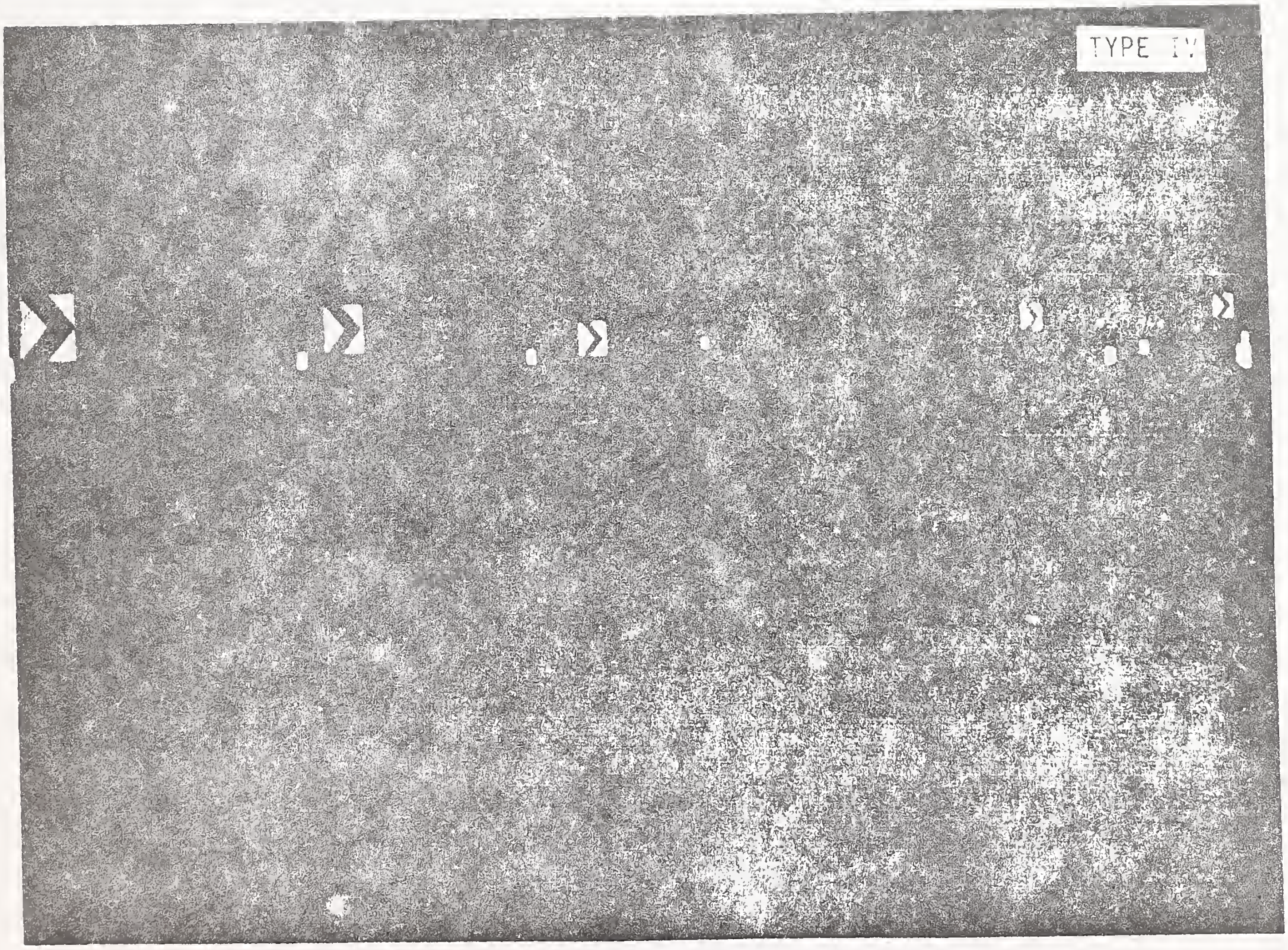
MILE MARKER
FROM : 141.9
TO : 142.3

SIGN TYPE
IV




TYPE III


TYPE III


TYPE IV